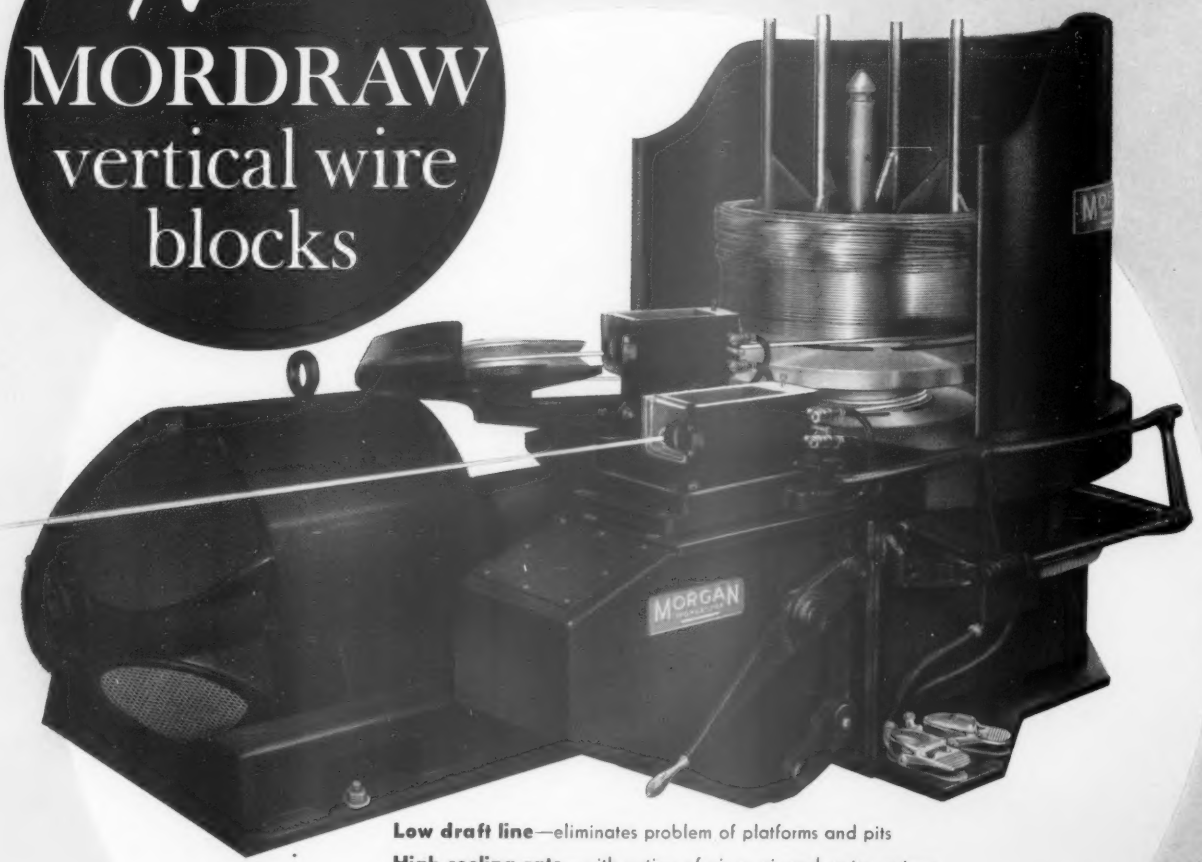
WIRE
AND WIRE PRODUCTS
AUGUST 1961

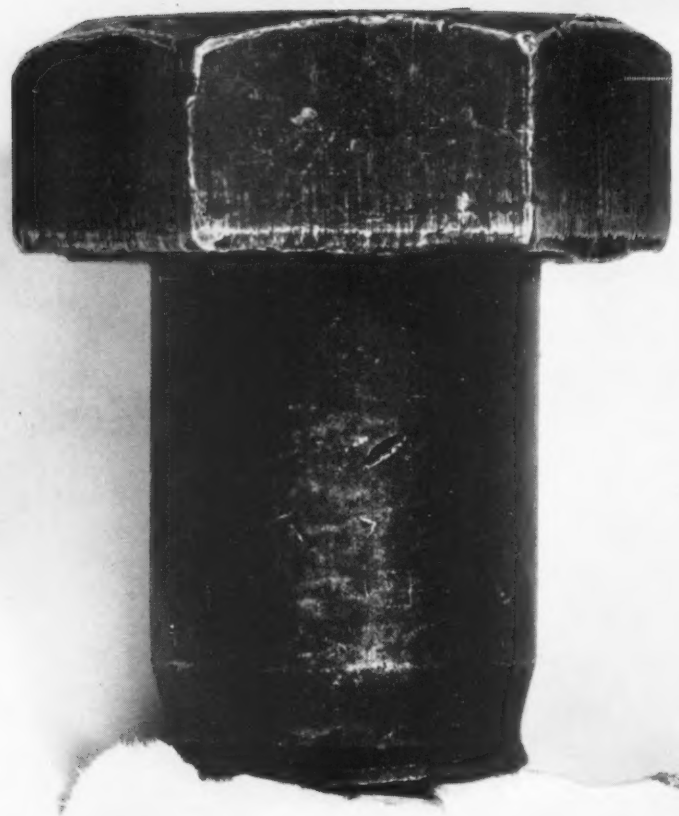
New
MORDRAW
vertical wire
blocks



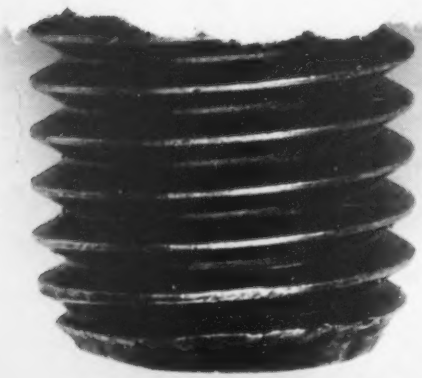
Low draft line—eliminates problem of platforms and pits
High cooling rate—with option of air or air-and-water systems
Double deck die boxes—individually adjustable, mounted on same bracket to eliminate crossing rod line to thread upper deck
Conserved floor space—with motor located beside die box
Quiet operation—achieved by worm gear drive assembly
Easy block changes—speeded up through use of tapered fits
Available in a range of capacities to meet production requirements

MORGAN CONSTRUCTION COMPANY
WORCESTER, MASSACHUSETTS

FFICIAL PUBLICATION OF THE WIRE ASSOCIATION

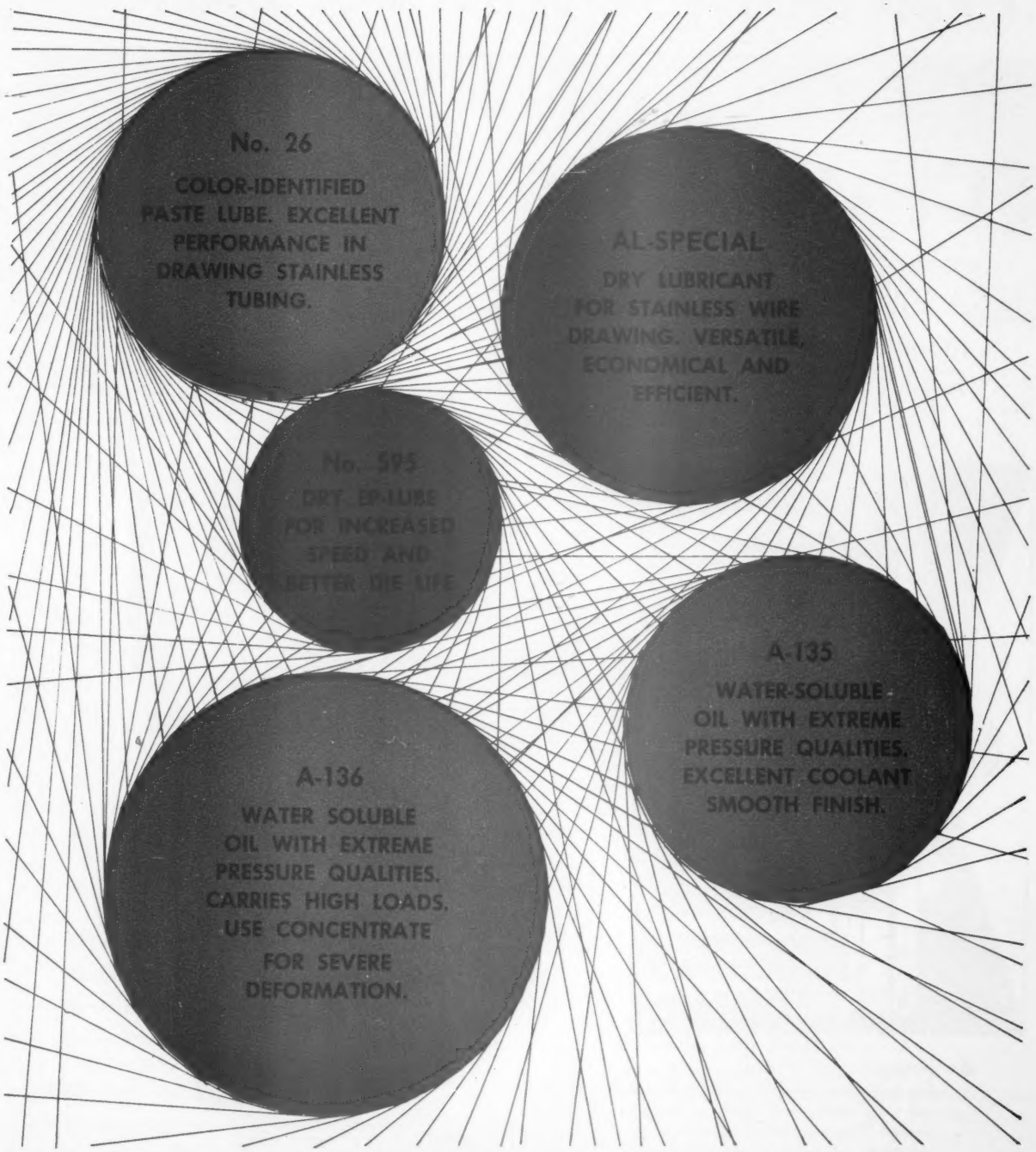


Bolts are better now because wire and rod used in their manufacture have a consistent quality and uniformity coil after coil. This is principally because of the constant innovations made in wire and rod processing equipment by the *Lee Wilson Engineering Co., Inc., 20005 Lake Road. Cleveland 16, Ohio. Remember the name.*



Lee Wilson

AMERICA'S FOREMOST BUILDERS OF ANNEALING EQUIPMEN


No. 26
COLOR-IDENTIFIED PASTE LUBE. EXCELLENT PERFORMANCE IN DRAWING STAINLESS TUBING.
AL-SPECIAL
DRY LUBRICANT FOR STAINLESS WIRE DRAWING. VERSATILE, ECONOMICAL AND EFFICIENT.
No. 595
DRY EP-LUBE FOR INCREASED SPEED AND BETTER DIE LIFE
A-135
WATER-SOLUBLE OIL WITH EXTREME PRESSURE QUALITIES. EXCELLENT COOLANT SMOOTH FINISH.
A-136
WATER SOLUBLE OIL WITH EXTREME PRESSURE QUALITIES. CARRIES HIGH LOADS. USE CONCENTRATE FOR SEVERE DEFORMATION.

STANDARD INDUSTRIAL COMPOUNDS CO. INC.

FRANKFORT, ILLINOIS, USA

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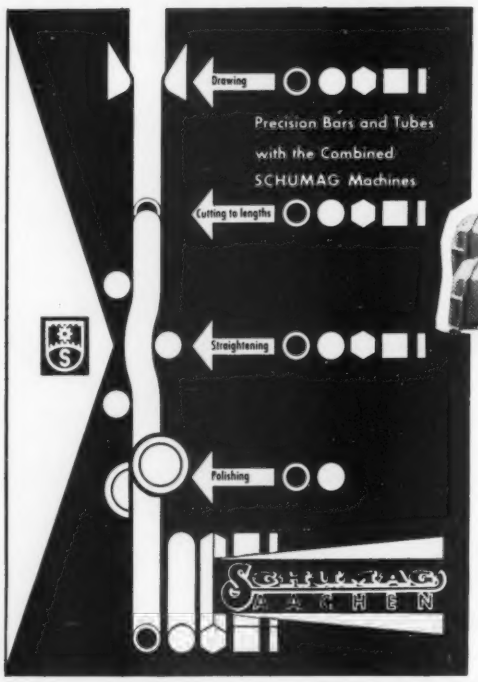
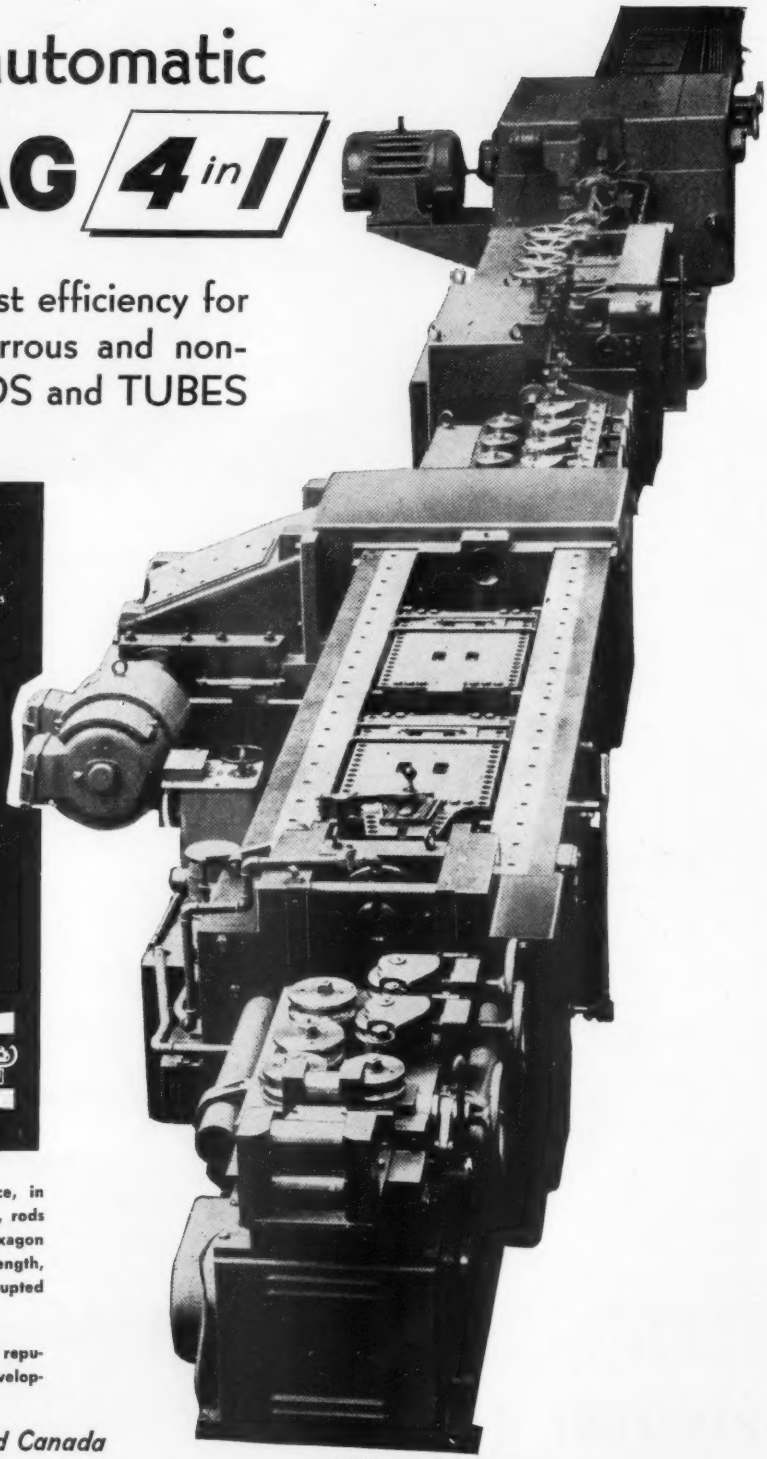
H. L. Blachford Ltd., 40 Titan Rd., Toronto, Ont.

SERVICE INTEGRITY DEPENDABILITY

The fully automatic
SCHUMAG 4 in 1

ASSURES... greatest efficiency for manufacturers of Ferrous and non-Ferrous BARS, RODS and TUBES





- SCHUMAG "4 in 1" machines produce, in one continuous operation, finished bars, rods and tubes from round, square or hexagon material. They will finish draw, cut-to length, straighten and polish in one uninterrupted sequence.
- SCHUMAG "4 in 1" enjoys world-wide reputation as the ultimate in technical development.

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Patent #2931891
and other patents pending

Now 3 MODELS

For copper or aluminum wire sizes #24 to #0, depending upon temperature and speeds required.

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MODELS: W-7½ • W-15 • W-22

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B) Front Enclosure Over Wheels
C) 50 Cycle
D) Multigroove Wheels
E) 3 Energized Wheels (in lieu of 2 standard wheels)
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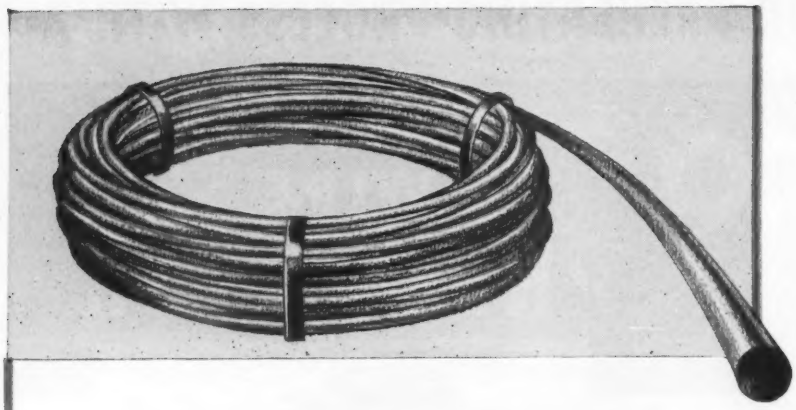
G) Saturable Core Reactor Type Transformer

Whether you preheat before extruding, or anneal before drawing, or preheat before coating, contact us.

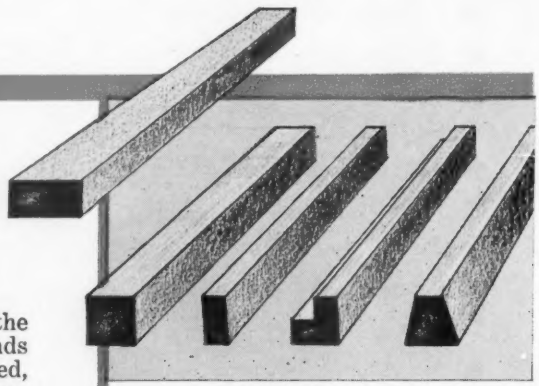
Telephone: PLantations 1-5400

WALCO ELECTRIC COMPANY
131 Blackstone St., Providence, R. I.



For Your Special Requirements Use

EATON-RELIANCE COLD FINISHED STEELS



Eaton-Reliance can furnish shapes in the range of .020″ x .020″ to ½″ x $\frac{9}{16}$″—rounds up through $1\frac{1}{16}$″ (coils or bars)—cold rolled, cold drawn special shapes—keystone—centerless ground, finished to your specifications. Produced by the most modern machinery under the most exacting quality control procedures, you can be assured Eaton-Reliance special steels will meet your requirements.

All steel finishing is done in our own mill by experienced craftsmen who draw and roll steel for ball and roller bearings —rings—springs—keys—pins and cold heading. Countless sections are available including round, square, flat, rectangular, step section, keystone and hex.

Eaton-Reliance also cold finishes several non-ferrous metals in addition to carbon, stainless and alloy steels.

Write for our 8-page catalog containing information about Eaton-Reliance cold finished steels and non-ferrous metals. No obligation.

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WIRE AND WIRE PRODUCTS*

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 36 August, 1961 No. 8

Designated as Official Publication By The Wire Association

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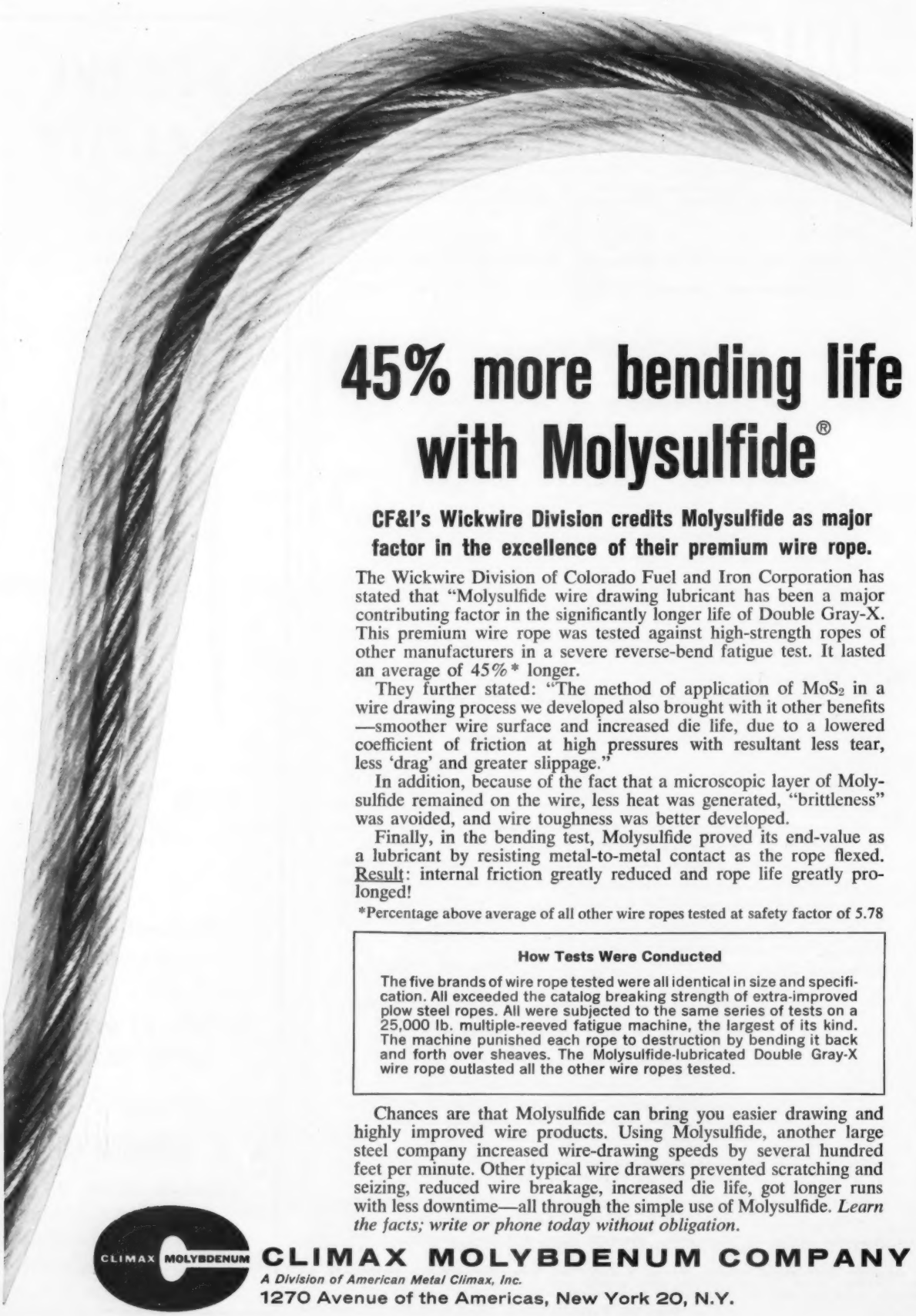
Please feel free to consult us with your wire cutting problems.



45% more bending life with Molysulfide®

CF&I's Wickwire Division credits Molysulfide as major factor in the excellence of their premium wire rope.

The Wickwire Division of Colorado Fuel and Iron Corporation has stated that "Molysulfide wire drawing lubricant has been a major contributing factor in the significantly longer life of Double Gray-X. This premium wire rope was tested against high-strength ropes of other manufacturers in a severe reverse-bend fatigue test. It lasted an average of 45%* longer.

They further stated: "The method of application of MoS_2 in a wire drawing process we developed also brought with it other benefits —smoother wire surface and increased die life, due to a lowered coefficient of friction at high pressures with resultant less tear, less 'drag' and greater slippage."

In addition, because of the fact that a microscopic layer of Molysulfide remained on the wire, less heat was generated, "brittleness" was avoided, and wire toughness was better developed.

Finally, in the bending test, Molysulfide proved its end-value as a lubricant by resisting metal-to-metal contact as the rope flexed. Result: internal friction greatly reduced and rope life greatly prolonged!

*Percentage above average of all other wire ropes tested at safety factor of 5.78

How Tests Were Conducted

The five brands of wire rope tested were all identical in size and specification. All exceeded the catalog breaking strength of extra-improved plow steel ropes. All were subjected to the same series of tests on a 25,000 lb. multiple-reeved fatigue machine, the largest of its kind. The machine punished each rope to destruction by bending it back and forth over sheaves. The Molysulfide-lubricated Double Gray-X wire rope outlasted all the other wire ropes tested.

Chances are that Molysulfide can bring you easier drawing and highly improved wire products. Using Molysulfide, another large steel company increased wire-drawing speeds by several hundred feet per minute. Other typical wire drawers prevented scratching and seizing, reduced wire breakage, increased die life, got longer runs with less downtime—all through the simple use of Molysulfide. *Learn the facts; write or phone today without obligation.*

CLIMAX MOLYBDENUM

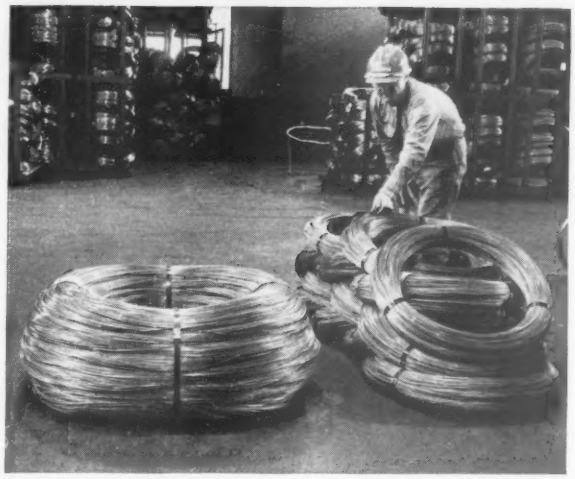
CLIMAX MOLYBDENUM COMPANY

A Division of American Metal Climax, Inc.

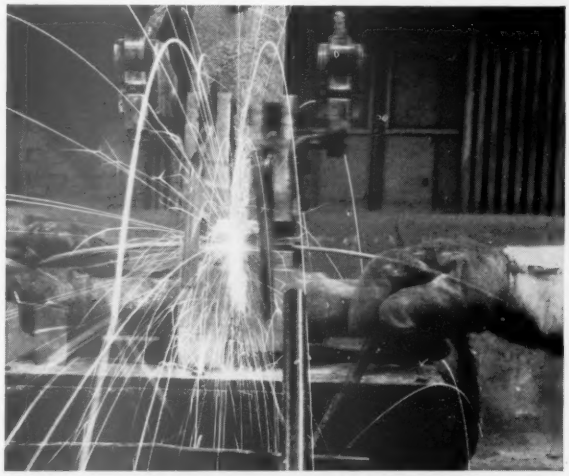
1270 Avenue of the Americas, New York 20, N.Y.

Here's how Bethlehem Wire in heavyweight coils cuts your costs

Bethlehem heavyweight coils, with from 1,000 to 2,000 lb of wire in one continuous length, offer these cost-cutting advantages:

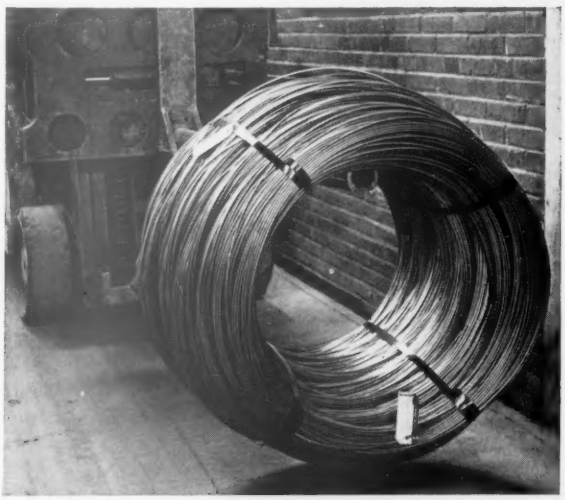


REDUCED MACHINE DOWN-TIME—By using the heavyweight coil, instead of 13 150-lb catchweight coils, you save a maximum of 12 costly machine shutdowns necessary every time you start a standard size coil.



LESS BUTT-WELDING AND COIL REMNANT SCRAP—In operations requiring the welding of coil ends, the time and cost of butt-welding is reduced. And there's less waste in the form of coil remnant scrap.

NO DEPOSITS . . . NO RETURNS—Returnable carriers are not needed with Bethlehem heavyweight coils. Carriers take up valuable storage space, involve extra paperwork, and tie up your cash.



MINIMIZED HANDLING COSTS—One man, operating a fork-lift, crane, or ram truck, can easily handle a heavyweight coil. Speedy unloading. Efficient stacking.

BUNDLED THE WAY YOU WANT THEM—We can supply our heavyweight coils with or without a pallet, for use on welded steel cores (rotating or stationary payoff).

Want more information? Get in touch with our nearest sales office. Or write to us at Bethlehem, Pa.

Steel *for Strength . . . Economy . . . Versatility*

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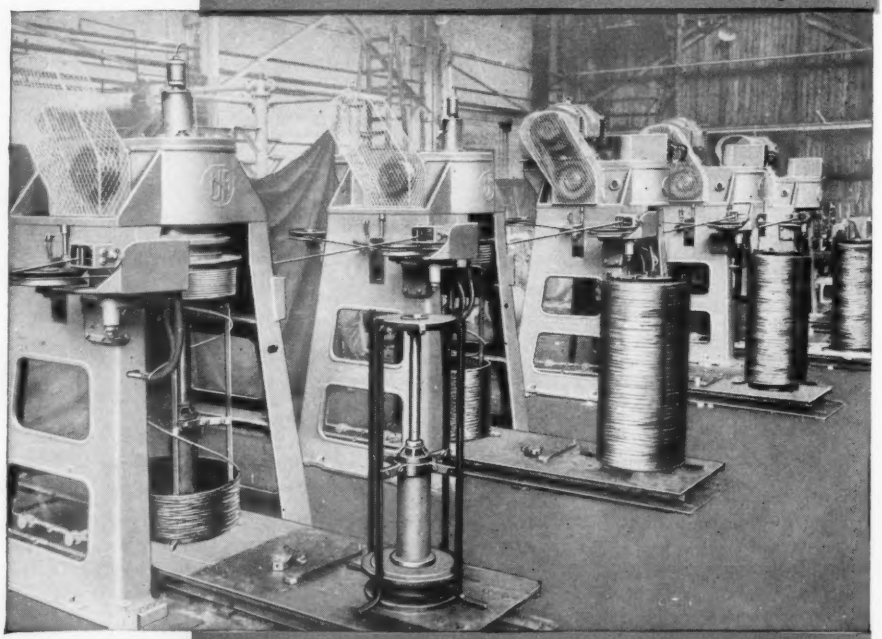
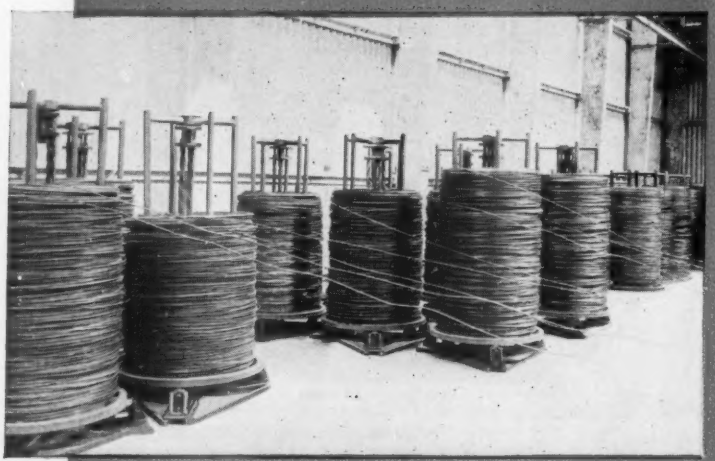
BETHLEHEM STEEL

BETHLEHEM STEEL

Farmer Norton Gravity blocks for handling large coil weights. These can be built for coils up to 2,000 lb or larger. The units can either draw or wind as required. Can be fitted with constant or variable speed motors. DO NOT TWIST THE WIRE. This is essential for Carbon Steel wire. Are built in block sizes from 36" to 12" diameter.



Five Double draft Gravity blocks drawing 15 cwt coils of mild steel wire 5.4 mm to 3.7 mm or Single Draft 5.4 mm to 4.4 mm. Drawing speeds 600 ft/min and 800 ft./min. All five of these blocks are operated by one man.

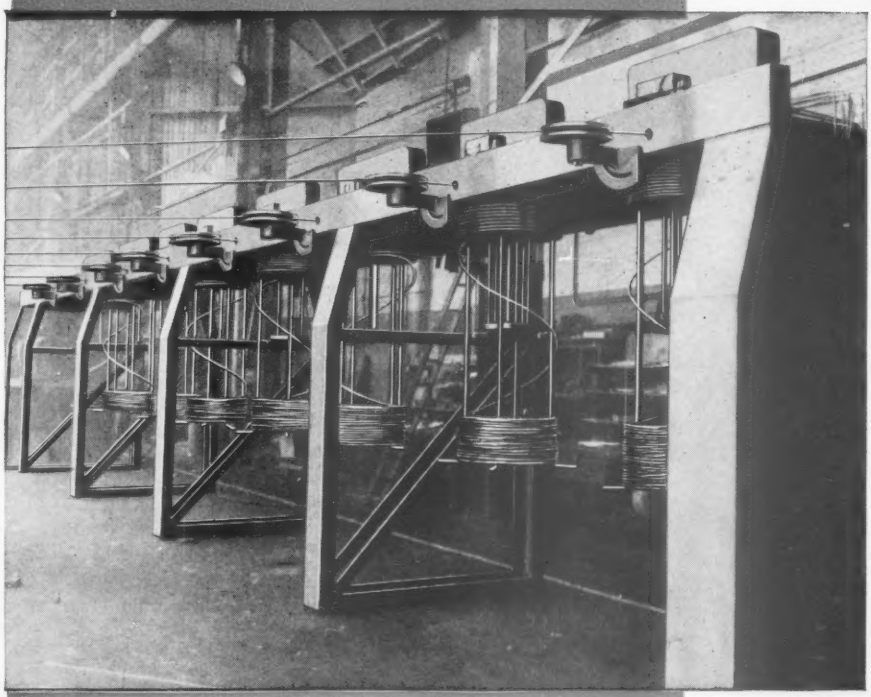


Large coils of this type drawn on Gravity blocks are ideal for feeding cutting machines, nail machines, patenting and galvanising furnaces etc.

SIR JAMES FARMER NORTON & CO. LTD.,

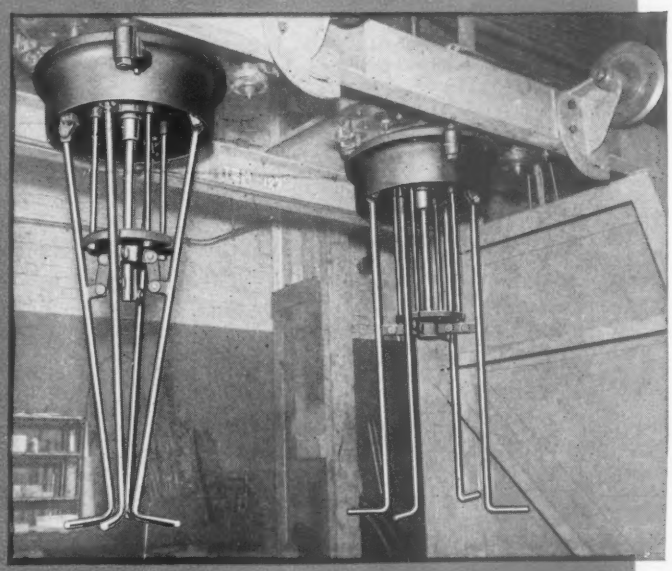
ADELPHI IRONWORKS, ADELPHI STREET, SALFORD 3, ENGLAND. Telephone BLAckfriars 3613/4/5

Agent: Steel & Wire Machinery Inc., 15457 Euclid Avenue, Cleveland 12, Ohio, U.S.A.



Eight head machine for collecting Galvanised wire 5mm - 1.6 mm. in 1,000 lb coils. Drive through variable speed oil gear to give winding speeds of 0 - 150 ft/min. For larger coils up to 2,000 lb a different design of wire collectors is used.

OVER 200 GRAVITY BLOCKS SUPPLIED TO OUR CUSTOMERS THROUGHOUT THE WORLD:–



In United Kingdom
Australia
India
Pakistan
France
Belgium

Orders are being executed for U.S.A.

Take up frames for Galvanising, tinning and heat treatment.

The strippers are collapsed pneumatically.

. . . who are the Inventors and Pioneers of this inverted system of drawing.

Hooks loaded with coils of wire are speedily handled from one tank to another with this Cleveland Tramrail gantry crane. Crane travel motor drive and hoist machinery are located in the leg of the crane where protected from corrosive fumes.

Gantry Crane Provides *Efficient* Straight-Line Wire Cleaning

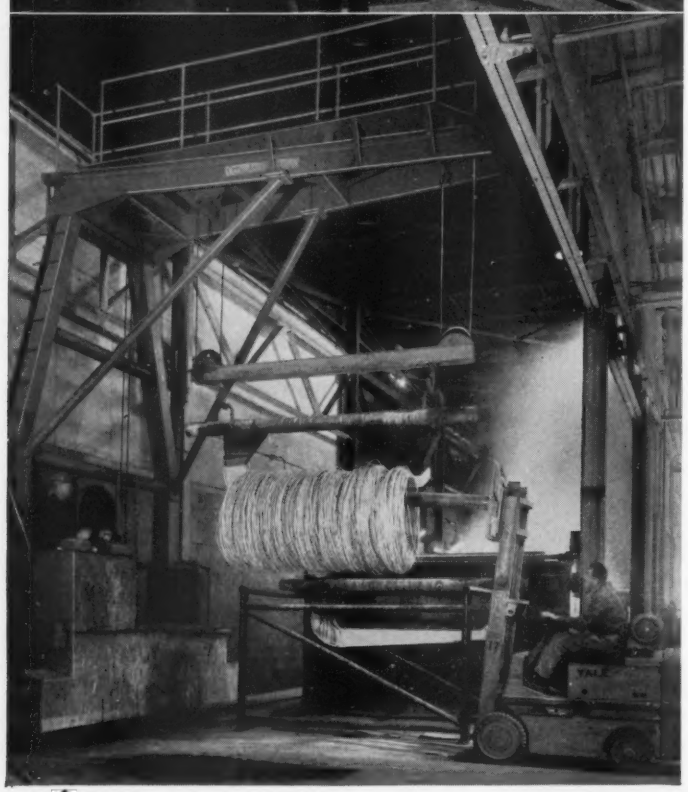
All wire is cleaned and lime-coated with a Cleveland Tramrail cleaning house gantry crane in the modern Dosco Wire Mill of Dominion Steel and Coal Corporation, Ltd., Toronto, Canada.

This is a very efficient operation requiring only one man in the crane cab to carry on the entire cleaning job. By means of convenient electrical controls, he keeps the gantry busy lowering hook loads of wire into the several tanks for various time lengths. Cleaned wire is lifted directly off the crane hook by a floor truck, thus eliminating a time-consuming step in handling.

Cleveland Tramrail pioneered the use of especially-designed single-leg gantry cranes for cleaning house service. The development completely changed this branch of wire manufacture from an untidy, messy, laborious operation to a clean, orderly, efficient one.

Most wire and rod cleaning houses are now equipped with Cleveland Tramrail installations. They are preferred because they are backed by many years of experience and designed to provide long trouble-free life despite the severe corrosive acid conditions involved.

Write for Booklet 2008

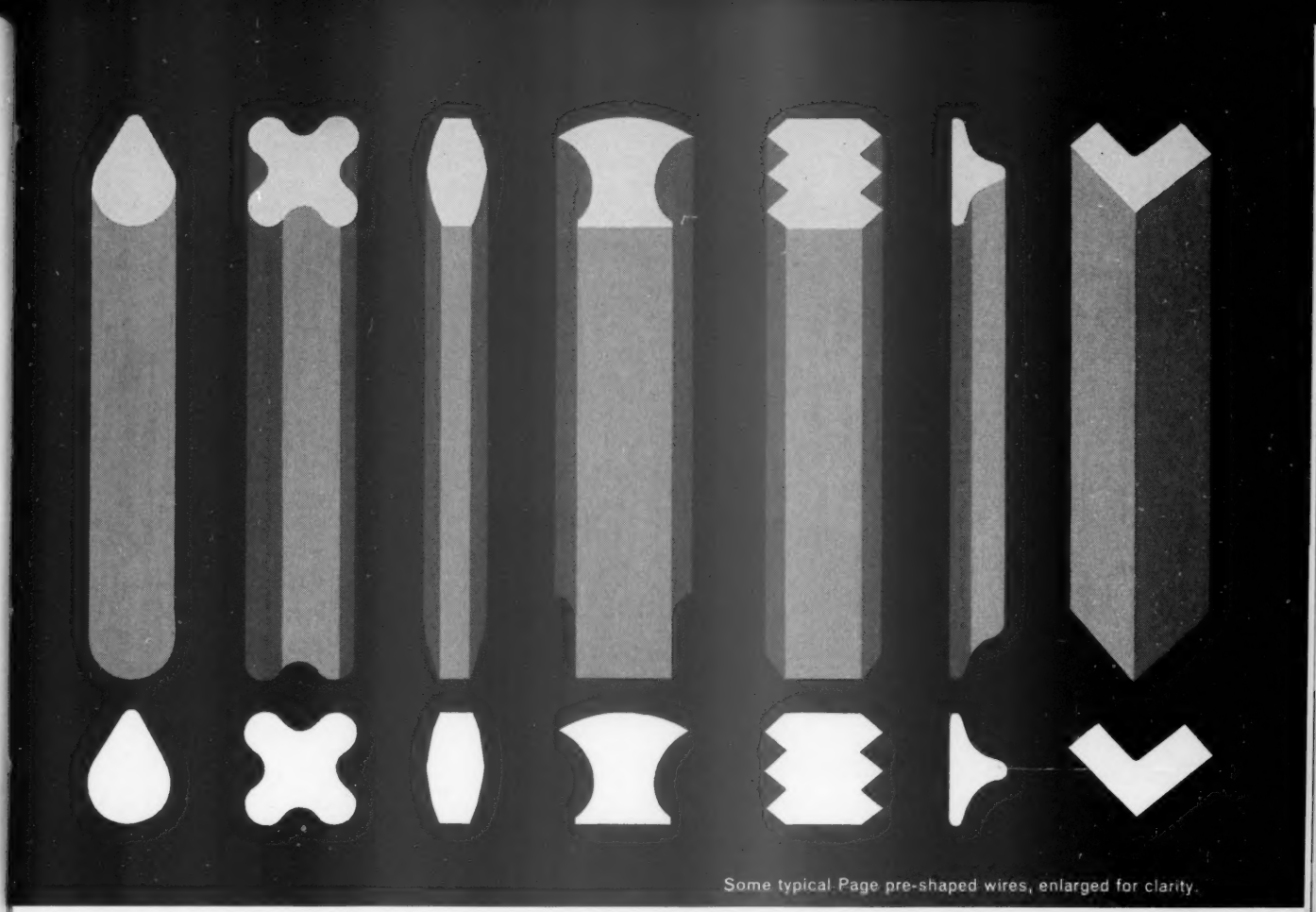


Transferring a load of prepared wire from the gantry hook to a floor truck.

CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 9225 E. 288 ST. • WICKLIFFE, OHIO



Some typical Page pre-shaped wires, enlarged for clarity.

Cut your costs, improve your product with PAGE *Pre-Shaped* WIRE!

PAGE *pre-shaped* wire simplifies product design, reduces material costs. It requires no machining, no forming, no forging. It's delivered to you in *any* shape you require—from the simplest standards to complex "specials" made from your own drawings. You can specify low carbon, high carbon, alloy or stainless steels, or ARMCO ingot iron. The PAGE mill is America's leading special-purpose wire producer, so your specifications regarding physical properties and size tolerances are no problem. What's more, you can order your PAGE *pre-shaped* wire shipped with the kind of packaging you want. Most important, you can *always* count on PAGE uniformity.

Send us a sample of the shaped wire you now use, or a description of your wire needs—prove to yourself how PAGE can help. Tell us your wire analysis and tonnage requirements. We'll recommend a PAGE *pre-shaped* wire to help reduce your costs, simplify your manufacturing and improve your product.

Write us at Monessen, Pa. for Booklet **DH-1226** on PAGE *pre-shaped* wire, or for information on what PAGE has to offer to meet your other wire requirements

PAGE

the source for answers to wire problems

ACCO

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So soluble it can be added to tap water! An all synthetic formulation designed for faster pickling at low temperature. Liquid RODINE 23 exhibits high-foaming, free rinsing characteristics, while retaining its solubility and effectiveness even at extreme temperatures and iron concentrations.

. . . PLUS an improved

RODINE 82A

New reaction techniques provide RODINE 82A with complete solubility in dilute acid—soluble in tap water, *too!*

. . . and still another improvement

RODINE 92A

Superior solubility provides steel mill picklers with another specialized RODINE for their particular applications. RODINE 92A incorporates a highly efficient wetting agent.

Why not send for complete information on these latest developments from the Amchem Research Laboratories.

AMCHEM **RODINE**

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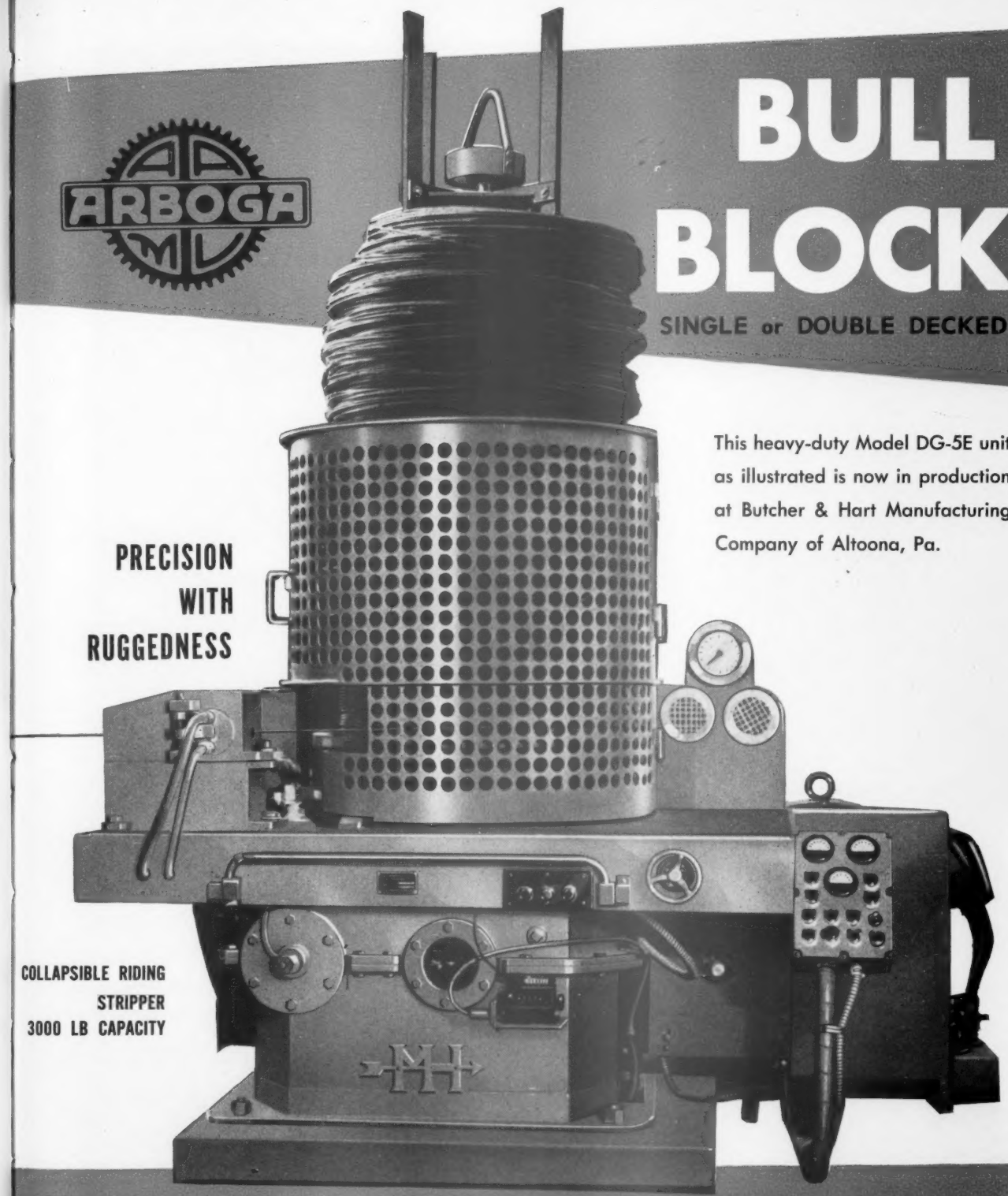
BULL BLOCKS

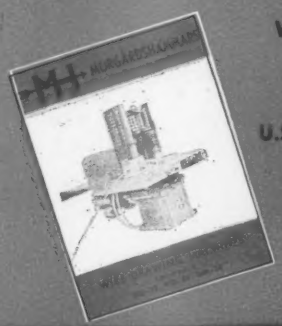
SINGLE or DOUBLE DECKED



This heavy-duty Model DG-5E unit as illustrated is now in production at Butcher & Hart Manufacturing Company of Altoona, Pa.

PRECISION WITH RUGGEDNESS

COLLAPSIBLE RIDING STRIPPER
3000 LB CAPACITY



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Dimensions of Sumitomo Wire Rods

Diameter 5mm. (13/64″) — 16mm. (5/8″)
Weight Single Bundle
about 270 kgs. — 320 kgs.
600 lbs. — 700 lbs.
Compressed Bundle (6 coils)
about 1,620 kgs. — 1,920 kgs.
3,600 lbs. — 4,200 lbs.
Coil Dimensions on Request

LEADING PRODUCERS OF STEEL WIRE RODS, PIPE AND ROLLING STOCK PARTS

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Cable Address: "SUMITMETAL NEWYORK"

An outstanding line of LOUIS ALLIS adjustable-speed drives from ½ to 2500 hp.

Louis Allis offers you a complete line of adjustable-speed drives with various characteristics for every application where adjustable speed is required.

Experienced Louis Allis field engineers, supported by regional and factory industry specialists, will help you select the best drive or drive system to meet *your* requirements.

The Louis Allis line of drives provides outstanding control features ranging from simple manual to precise electronic or transistorized control. Selection of control varies, of course, with the nature of the installation and the precision required. Where desirable, speed regulation as close as .1% is obtainable.

Controls can be provided which automatically respond to temperature, pressure, or flow. Other control features include threading, inching, jogging, logarithmic acceleration, torque-limit acceleration, tachometer feedback... and many other control provisions that can exactly tailor a Louis Allis drive to *your* operation.

For process plants or applications involving inter-related motors and multiple drives, Louis Allis engineers can provide complete "systems engineering," furnishing all electrical rotating components and control.

For expert assistance, call your local Louis Allis District Office listed in the Yellow Pages under "Electric Motors"... or write direct to The Louis Allis Company, 451 East Stewart Street, Milwaukee 1, Wisconsin. Ask for Bulletin 2900, "Louis Allis Adjustable Speed Drives."

*TM EATON MFG. CO.

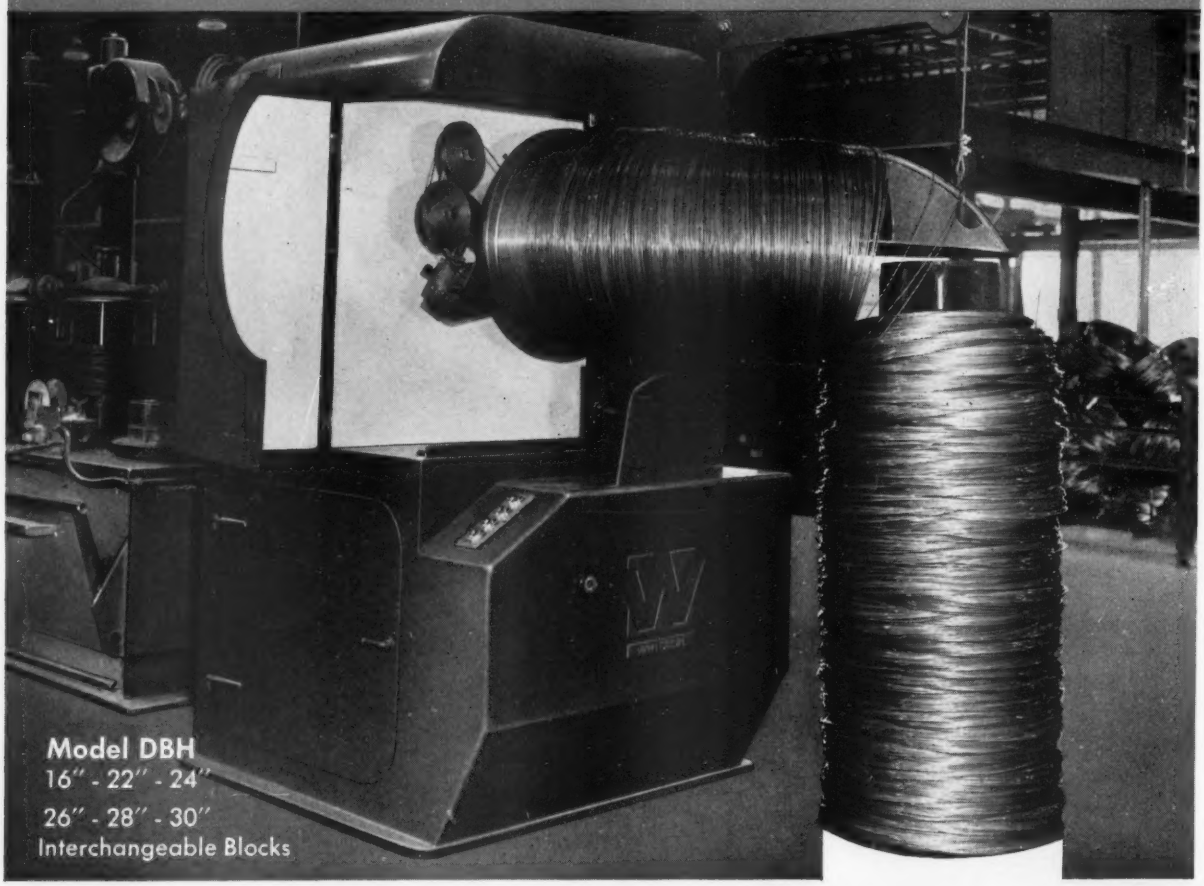
LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

ASD-238

WHITACRE WIRE DRAWING DEAD BLOCK

Water Cooled Die and Block Available



Save with these advantages:

You get continuous increased production because no down time is necessary for stripping...changing dies in a supplying drawing machine..."run down" of accumulation type machines... packaging into stationery container or uninterrupted palletizing on stems... inspection or sampling. There is no tangling nor snarling from handling • Breaks welded in production • No back gearing nor similar mechanism • You save by greatly reduced floor space requirements • Dead block can be located anywhere with wire literally piped from wire drawing machine • Low scrap loss • Increased production through lessened operator fatigue • Design simplicity • Maintenance eliminated except for occasional lubrication of main bearings and motor bearings • Extra large packages for in-process wire • Greatly reduced handling and in-plant transportation costs • Low capital investment.

MODELS AVAILABLE

16" Wire Drawing Dead Block, Model DBM • Model DBH 16" to 30". Model DBXH 30" Wire Drawing Dead Block for heavy gauges and rods including ⅜" • Combination Galvanizing or Tinning Dead Block Take-ups, 16" to 30", Model GF • 26" Heavy Wire Galvanizing or Tinning Dead Block Take-up, Model GFH. Write today for specifications.

APPROACHES

100%

CONTINUOUS

PRODUCTION

EFFICIENCY

WHITACRE CORPORATION

5649 Alhambra Ave. • Los Angeles 32, California • CApitol 5-2476

Specialties of the House

ROEBLING is a specialist in galvanizing, with practically unmatched facilities for producing galvanized wire in enormous quantities and in complete size ranges. Hot galvanized is available in sizes from .283″ to .035″. . . Roegal® (drawn galvanized) from .187″ to .005″.

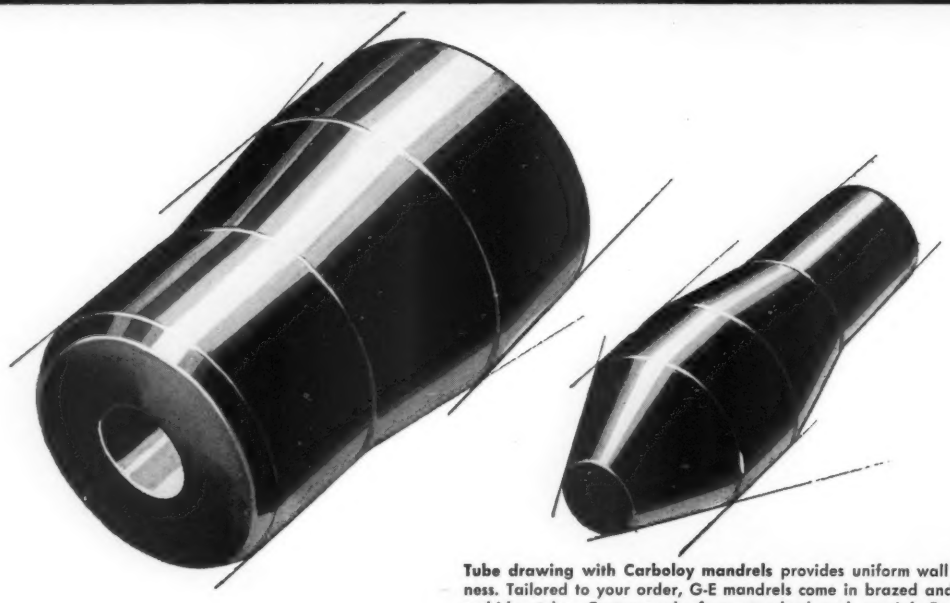
You *pay* for the best when you buy galvanized wire. Make sure you *get* it—specify Roebling! For complete information, write Roebling's, Wire and Cold Rolled Steel Products Division, Trenton 2, N. J.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division • The Colorado Fuel and Iron Corporation

Roebling... Your Product is Better for it

"MOVING METAL" with Carboloy® Cemented Carbides

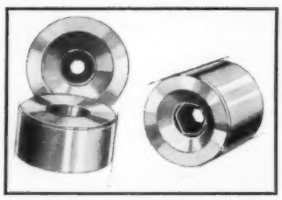


Tube drawing with Carboloy mandrels provides uniform wall thickness. Tailored to your order, G-E mandrels come in brazed and solid carbide styles. Custom-made from standard and special Carboloy nibs. Available from your Authorized Die Distributor or Die Maker.

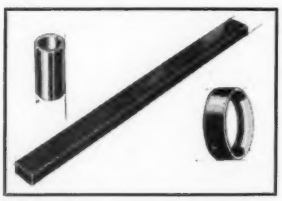
Lower your costs, reduce metal waste with high-quality Carboloy® dies

How efficiently you "*move metal*" from one shape to another depends on the quality, accuracy and uniformity of the carbide you use. General Electric Carboloy carbides for wire, bar, and tube-drawing dies are designed to do the job better at lower cost, and with less metal waste.

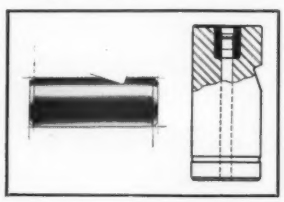
Continuing research by General Electric's experienced metallurgists and technicians results in carbides of highest quality and uniformity — dependability for the job at hand. Call your Carboloy Die Distributor or Die Maker to help you "*move metal*" at lower cost. Or write: *Metallurgical Products Department of General Electric Company, 11171 E. 8 Mile Street Detroit 32, Michigan.*



Get more wire tonnage with uniform size and finish. Carboloy carbide wire, bar and tube dies boost product output, permit longer runs with less die wear, minimize downtime. Available in round, square, hexagon shapes.



Boost wire production schedules by wear-proofing critical parts with G-E carbide wire guide bushings, strips, and guide rings on wire stranding and processing machinery. Last up to 100 times longer than those of other materials.



Top quality and performance in boltmaking machinery depend on header and extrusion dies equipped with Carboloy cemented carbides—to produce more uniform parts to closer tolerances; resist stress and strain of heading and extruding operation.

CARBOLOY CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

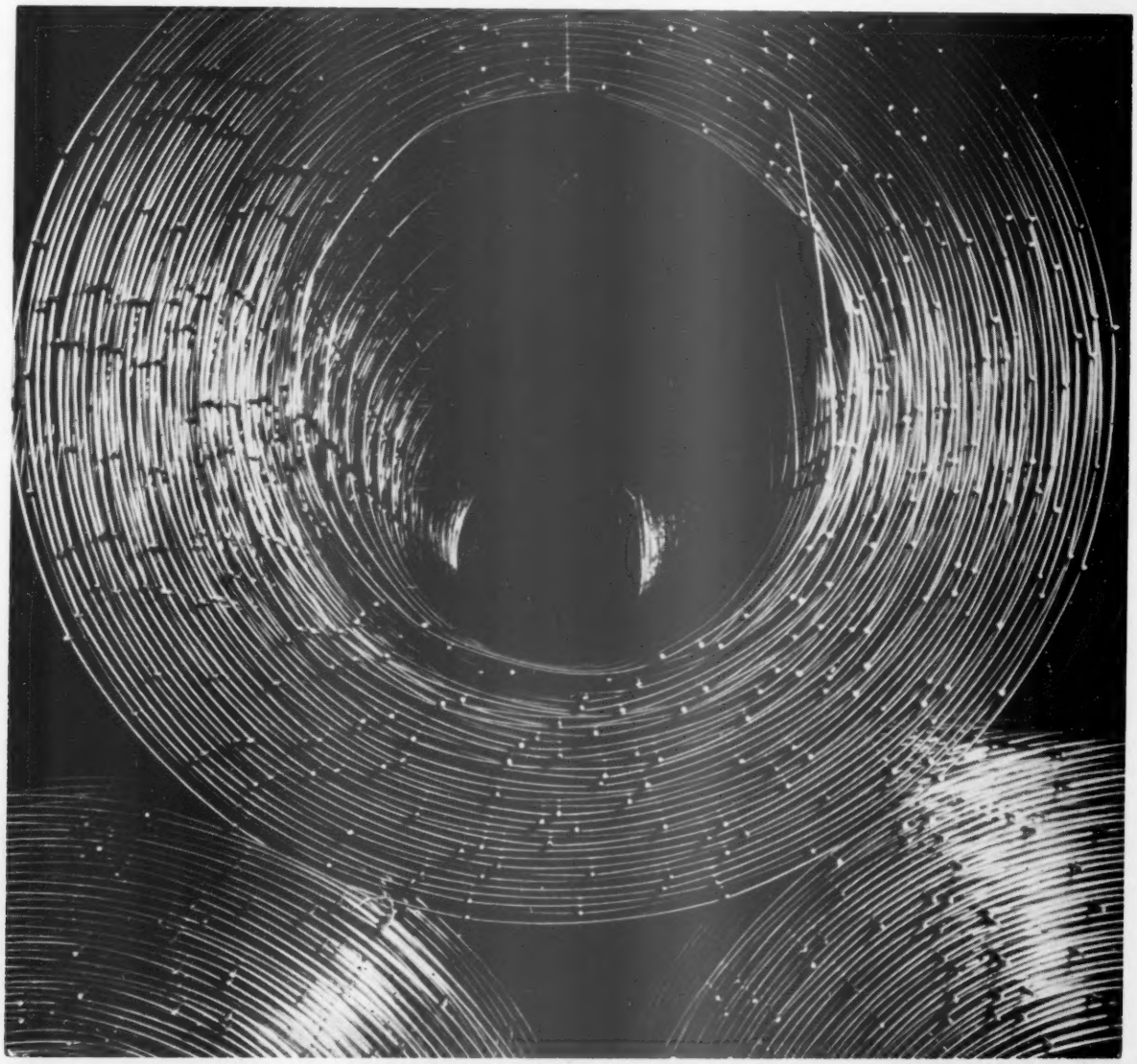
GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMOND • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

SCHLATTER

We have been specialising in the construction of resistance welding machines for nearly half a century. Fifteen years ago we produced the first mesh welding plant. This long experience has been utilised in the development of our modern mesh welding plants, and our manufacturing programme now includes a comprehensive range of machines.

Model 1 for light mesh in rolls and sheets	Wire 0.06—0.16 inch dia., width 79 inch.
Model 2 for mild steel mesh in rolls	Wire 0.12—0.24 inch dia., width 104 inch.
for mild steel mesh in sheets	Wire 0.12—0.39 inch dia., width 104 inch.
Model 3 for mild steel mesh in rolls	Wire 0.12—0.24 inch dia., width 147 inch.
for mild steel mesh in sheets	Wire 0.12—0.39 inch dia., width 147 inch.
Model 4 for mild steel mesh in sheets	Wire 0.16—0.47 inch dia., width 147 inch.
Model 5 for heavy mild steel mesh in sheets	Wire 0.16—0.47 inch dia., width 104 inch.



H. A. SCHLATTER Ltd. ZOLLIKON-ZURICH (Switzerland)

Manufacturers of Electric Welding Machines and Electronic Controls

Canadian Representative: Paul Reicher, Machinery and Equipment Ltd.,
600 Eglinton Ave. East, Suite 307 - IBM Building, Toronto 12, Ontario

MIYAZAKI

MODEL DC-SP-I

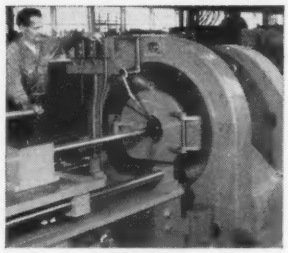
BAR MAKING COMBINER

DRAWING, STRAIGHTENING, CUTTING, AND POLISHING MACHINE

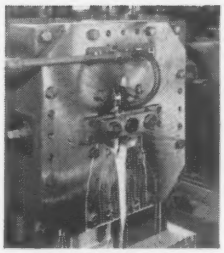
This machine performs the entire process of Drawing, Straightening by Roll, Cutting, Straightening by Ring and Polishing of steel or nonferrous metal bar in coil consecutively and automatically.

TYPE	TRACTION POWER (Kg)	HP REQUIRED	MATERIAL	SPEED (m/min.)	OUT PUT CAPACITY (mm)			
					●	⬢	■	▬
DC-SP-I	2500	40	Steel	40	4 — 13	5 — 13	4 — 11.8	max 9 × 15
			Nonferrous metals	30	4 — 15	5 — 13	4 — 11.8	11.8 × 15
DC-SP-II	6000	55	Steel	30	10 — 20	10 — 18	10 — 18	12 × 25
			Nonferrous metals	22.5	10 — 25	10 — 22	10 — 22	20 × 25

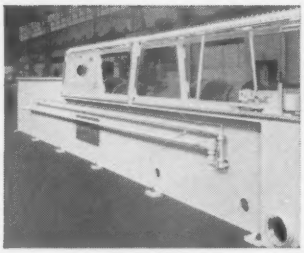
Miyazaki Iron Works, Ltd.
Kaizuka, Osaka, Japan.



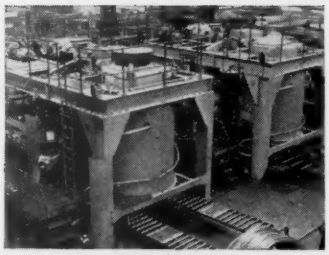
SWAGING MACHINES



TURKS HEADS

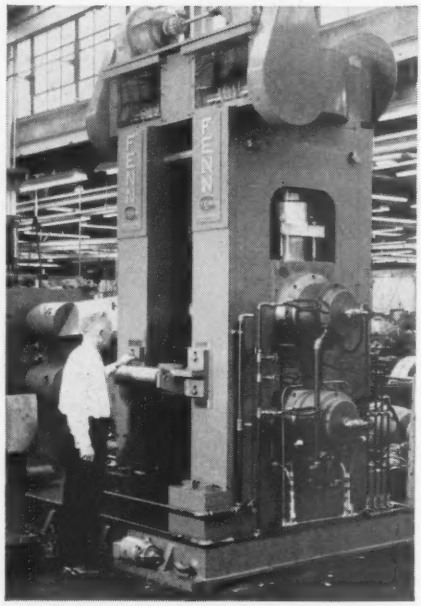


DRAW BENCHES



WIRE AND TUBE MILLS

PRECISION • PERFORMANCE • DEPENDABILITY



ROLLING MILLS

WIRE FLATTENING LINES

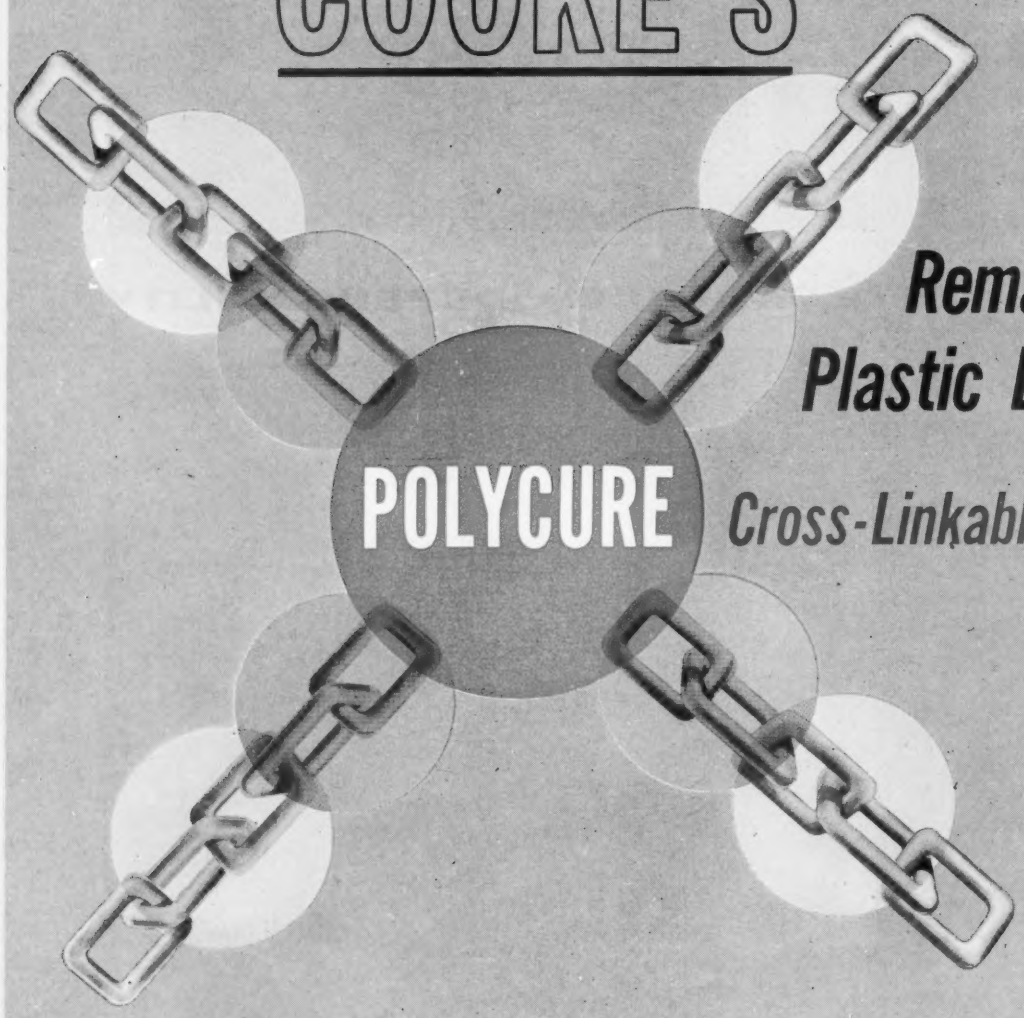
METAL FORMING MACHINES

that meet the challenges of the 60's

Within a relatively short span of years the name FENN has become well-known to users of metal forming equipment. In rolling mills . . . wire mills . . . in the nuclear industry . . . and wherever else ferrous or nonferrous metals are rolled, drawn, or formed to precision tolerances, Fenn machines are producing profits for their users. The extensive Fenn line is built on long experience in the manufacture of *precision* machinery and an equally long reputation for *performance* and *dependability*. Behind every Fenn machine is unexcelled engineering . . . from design to inplant checkout and continuing field service, plus an organization that strives to do every job better than the expected. Whatever your metal forming machinery requirements, you can depend upon your nearest Fenn representative for his experienced advice and practical help. Comprehensive literature will be promptly sent upon request. The Fenn Manufacturing Company, Fenn Road, Newington, Connecticut.

Designed and Built by FENN

COOKE'S



Remarkable New Plastic Development

POLYCURE *Cross-Linkable Polyethylene*

POLYCURE is the latest from Cooke - a Vulcanizable Polyethylene, licensed under U. S. Patent No. 2,888,424. This new compound is available in colors as well as black for applications requiring better properties as listed below.

Write today for detailed POLYCURE information.

- **Moisture Resistant**
- **Ozone Resistant**
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- **Toughness**
- **Impact Resistant**
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- **Compact and Light Weight Construction**
- **Heat Stability and Ageing**
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- **High and Low Temperature Resistant**
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COOKE COLOR & CHEMICAL CO.

Hackettstown, N. J. GArden 5-5935

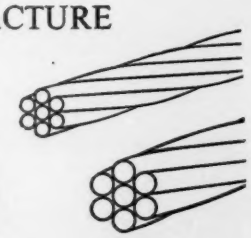
LARGE STRANDS

for prestressed concrete

❀ ❀ ❀

WE ALSO MANUFACTURE

SMALL STRANDS



and plain, indented or crimped wires

RYLANDS

Brothers Limited

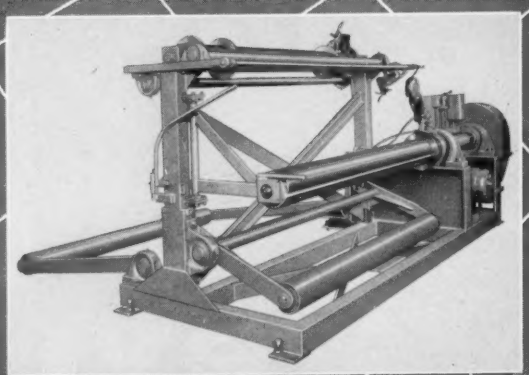
WARRINGTON
ENGLAND

MODEL FAB-33 STANDARD SPECIFICATIONS: Type of Fabric. The standard fabric welder is completely equipped electrically and mechanically to produce mesh in the following sizes and spacings.

WIRE GAUGE	LINE SPACING	STAY SPACING
11½ ga. thru 12½ ga. galv.	1", 2", 4", 6" & 8"	1", 2", 4", 6" & 8"
13 " " 14½ " "	1", 2", 4", 4" & 8"	1", 2", 4", 6" & 8"
15 " " 16 " "	½", 1", 2" & 4"	½", 1", 2" & 4"

Standard machine produces 78" wide fabric or multiples thereof.
Other gauge spacings and widths available upon request.

- QUICK CHANGE FROM ONE MESH TO ANOTHER
- HIGH SPEED OPERATION
- AUTOMATICALLY AND PERMANENTLY TIMED
- FULL ELECTRONIC CONTROL — NO RELAY
- FULLY SYNCHRONOUS TIMER, PHASE SHIFT HEAT CONTROL
- THREE PHASE BALANCED LOAD
- LOW ORIGINAL COST, LOW MAINTENANCE COST
- UNIT BUILT MINIMUM INSTALLATION TIME
- OPERATING IN TEN STEEL MILLS ACROSS THE COUNTRY



- CUSTOM AND AUXILIARY EQUIPMENT AVAILABLE TO YOUR SPECIFICATIONS SUCH AS REWINDERS, REELS, STUMPS, CONTROLS, ETC.

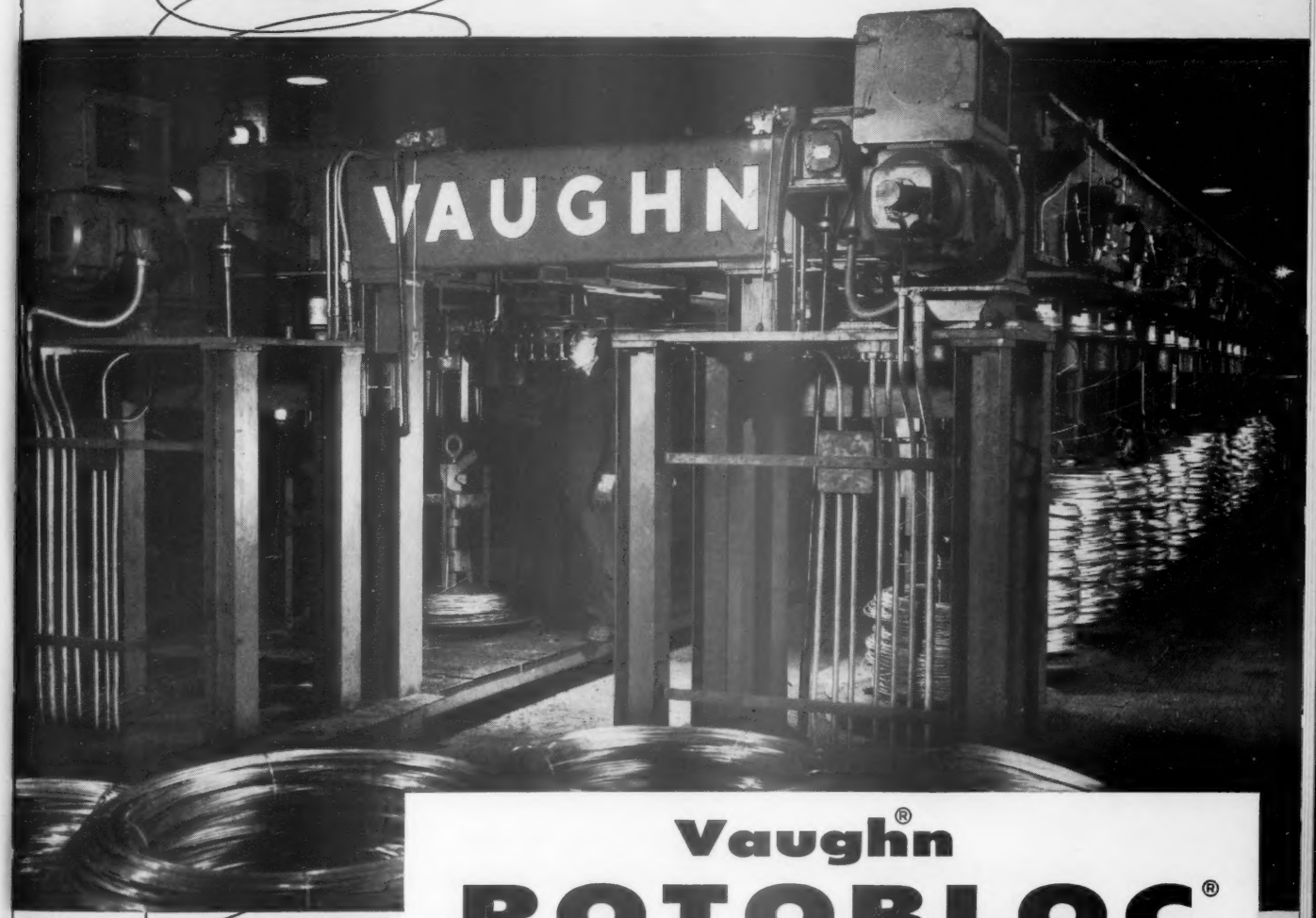
SOMMER PRODUCTS COMPANY

7100 S. ADAMS STREET — PEORIA, ILLINOIS

Large bundle–non-stop operation

without twist!

FOR USS AT DONORA WORKS, AMERICAN STEEL AND WIRE DIVISION



Vaughn® ROTOBLOC®

GALVANIZING · ALUMINIZING · PATENTING

This impressive 32-block Rotobloc installation underscores the increasing acceptance of Vaughn non-stop bundle production by leaders of the wire industry. The Vaughn Rotobloc, operating at the end of your wire processing lines, assures uninterrupted flow that means better deliveries for the customer and lower costs in the mill. ● This machine may be built in any number of blocks, and can also be designed for drum payoff, if desired. Size range is from 16 gauge galvanized to 13/32" patented wire. For additional details, write.

THE VAUGHN MACHINERY COMPANY

CUYAHOGA FALLS, OHIO, U.S.A.

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

V®

YAWATA STEEL. YAWATA STEEL

ACROSS THE SEAS TO WORLD MARKETS

Wire Rods of extremely high quality are produced by YAWATA for satisfied users throughout the world.

YAWATA, the biggest IRON and STEEL operation in the Far East, has the equipment and the knowhow to produce STEEL products of high quality and dependability.

When buying steel from JAPAN, specify YAWATA.

YAWATA IRON & STEEL CO., LTD.

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Cable Address: YAWATASTEEL TOKYO

European Office: Immerman Strasse 15, Duesseldorf, West Germany
Tel: 1-0463 Cable Address: YAWATASTEEL DUESSELDORF

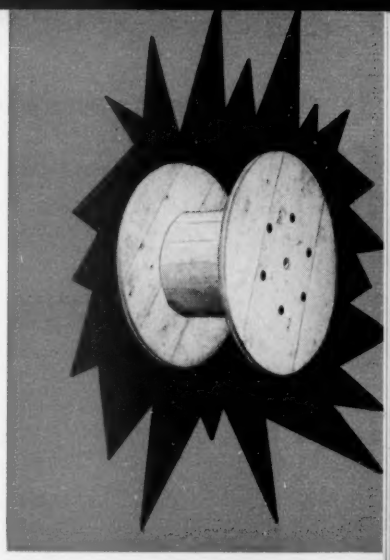
American Office: Room 2009, Seagram Building., 375 Park Ave., New York, 22, N.Y., U.S.A. Tel: Murray Hill 8-3327
Cable Address: YAWATAISCO NEWYORK

Saw mill at Bradford, N. H., where logs are processed into lumber.

HOW BRIDGE SUPPLIES ONLY THE BEST REELS

Our company is progressive. Since we began the manufacture of wood reels our plant has undergone continued expansion and improvement in production facilities.

In recent years modern affiliated companies have been established in New Hampshire to further enable us to better serve the growing needs of the wire industry.



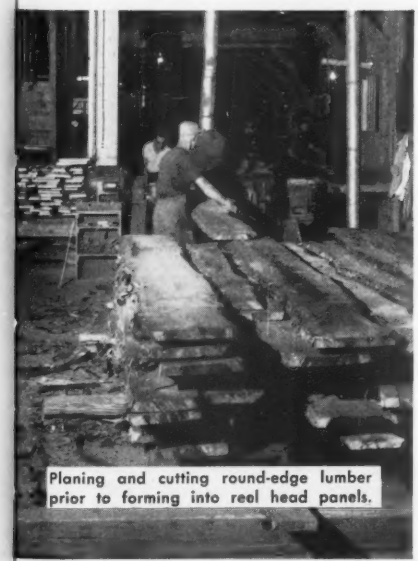
NON-RETURNABLE

WOOD REELS IN ALL SIZES FOR ALL TYPES OF ELECTRIC WIRE AND CABLE

- Controlled saw mill work
- Air seasoning of lumber
- Conversion of stock into panels and square-edge lumber
- Maintenance of millions of board feet of lumber in inventory
- Efficient, modern material handling methods and equipment

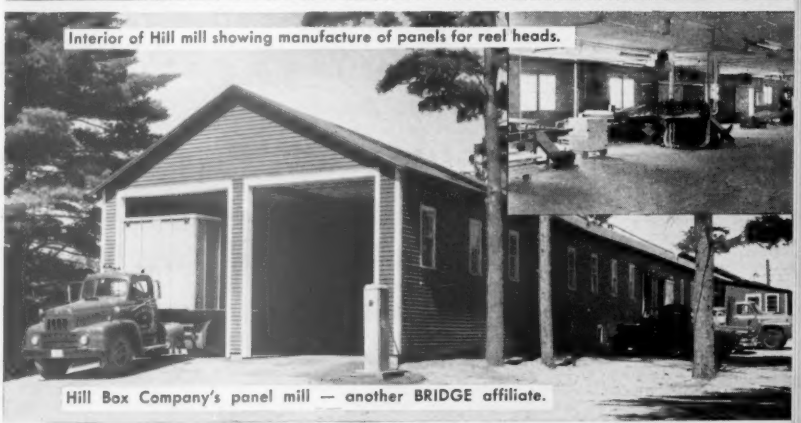
Interior of the Kearsarge plant.

Plant of Kearsarge Reel Co. — an affiliate of Bridge Manufacturing Co.



Planing and cutting round-edge lumber prior to forming into reel head panels.

NON-RETURNABLE REELS GIVE YOU A DEFINITE PACKAGING COST



Interior of Hill mill showing manufacture of panels for reel heads.

Hill Box Company's panel mill — another BRIDGE affiliate.

"REEL" GOOD —

Let us quote on your Reel needs. Send in your specifications. Better yet, visit our plant and see how Reels are made so well at so low a cost.

WOOD REELS

HIGH-SPEED SHIPPING SERVICE IN OUR OWN TRUCKS WITHIN A RADIUS OF 250 MILES OF THE PLANT, FAST FREIGHT WILL BRING YOU BRIDGE REELS WITHIN A FEW DAYS TO POINTS EAST OF THE MISSISSIPPI

TEL: THOMPSONVILLE, CONN.

"Tough-to-make"
Cold-Headed Products like these . . .

- Tubular Rivets (Punch Extruded).
- Non-threaded, multi-diameter, head and shoulder parts, drilled or not drilled.
- Washer and binding head screws with rolled threads.
- Special design fastenings and other small parts of intricate shape, with or without requirements for drilling or threading.

. . . become "routine" with

SCOVILL EXTRUDED Cold-heading WIRE

(Cartridge Brass, 70%)

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

IT HELPS YOU ELIMINATE

1. OUT-OF-ROUND HEADS
2. INCOMPLETE FILLING-OUT OF HEADS AND SHOULDERS
3. ROUGH "ORANGE PEEL" EFFECT
4. UNSOUND HEADED PARTS
5. RED STREAKS AND STAINS
6. NON-UNIFORM FLOW

Scovill furnishes this Cold-Heading Wire in non-welded coils up to 250 lbs. each.

SCOVILL®

Scovill Cold-Heading Wire is extruded from CONTINUOUS-CAST brass billets by the hot extrusion process, then cold-drawn and annealed in accordance with closely controlled mill procedures.

CONTINUOUS CASTING produces *more uniform metal* than any other process, both in chemical composition and in freedom from casting flaws or other variations.

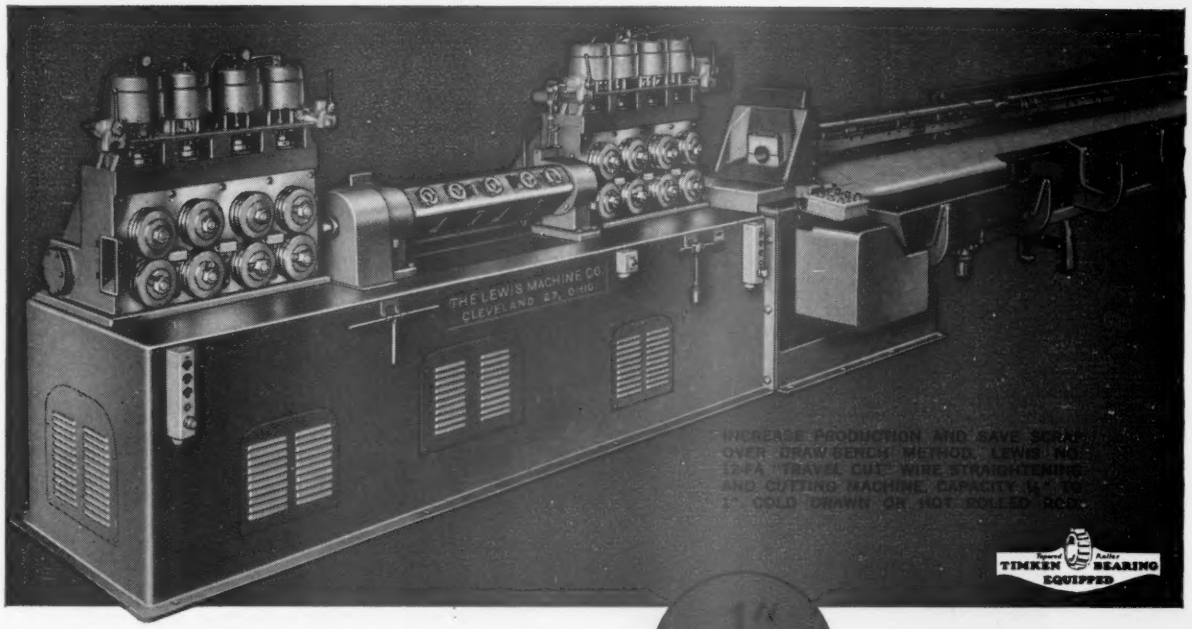
Scovill has standardized on *Cartridge Brass*, 70% for wire to be used in cold-heading operations. This alloy has a 5% HIGHER COPPER CONTENT than is generally found in brass cold-heading wire and is more ductile.

Prove this on your next wire order. Let us help you specify the proper closely controlled Scovill temper to produce more nearly perfect headed brass parts . . . whether you require "flow" characteristics for heading, or "flow" plus essential rigidity for secondary machining.

made better to bring out the ***BEST*** *in your products*

Scovill Manufacturing Company, Mill Products Division, 99 Mill St., Waterbury 20, Conn. Phone PLaza 4-1171.

12SC58R



Now...straighten and cut 1" dia. rod FROM COILS at speeds up to 350 fpm.

HERE'S WHY IT CAN BE DONE

CUT-OFF Flying Shear Type. Pure crank motion for both cutting and traveling permitting high speeds with minimum shock.

ROTARY ARBOR Two-speed with dual-center straightening dies for faster, more accurate straightening over a wide range.

ROLL HOUSINGS Dual-range pushbutton operated pneumatic feed pressure for exact feed control and coil end pull-through without twisting.

LENGTH GAUGING Light pressure on electric trip switch actuates air clutch. Wire is gauged and released with positive moving mechanism . . . springs and latches have been eliminated.

TRANSMISSION Positive sliding-gear type with eight feed speeds — 115 to 350 FPM.

Write for Brochure. Other models available to handle rounds from .012" to 1" dia. Shapes from 1/16 to 5/8" square, hex and flats.

THE LEWIS MACHINE COMPANY
A DIVISION OF CURTIS MFG. CO.
3441 EAST 76TH STREET • CLEVELAND 27, OHIO

FOR WIRE ROD THAT'S REALLY FINE--

say NIEDERRHEIN

Niederrhein means Quality

Niederrhein, Europe's largest wire rod facility, with its completely modern installations assures close tolerances for diameter and out-of-round, excellent surface and light scale.
Users report exceptionally good mechanical descaling properties.

Open Hearth grades from C 1005—1095
Low Metalloid
Thomas (Basic Bessemer) grades
Sizes from .200" —½"
Coils from 180—880 lbs.
Inside diameters 20, 24, 26, 33½"
Unitized bundles of 3000 lbs. are now our standard shipping package
Reliable delivery schedules at a fair price

KURT ORBAN
COMPANY, INC.

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In Canada: Kurt Orban Canada. Ltd.,
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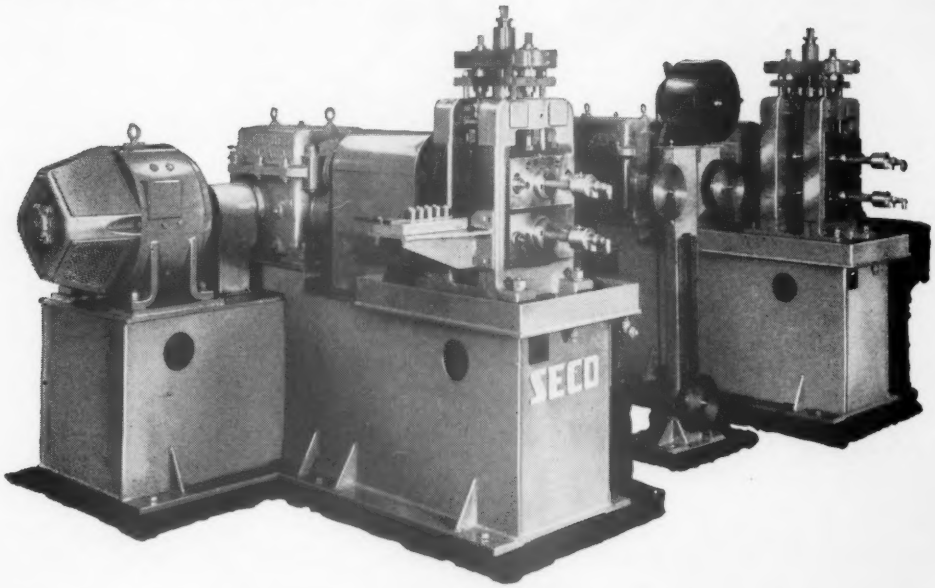
Predictable Performance

is yours when you change to

SECO WIRE FLATTENING MILLS



Acceptable and predictable performance "on both sides of the fence" when Seco Wire Flattening Mills are used in your operation.

Seco's staff of trained engineers . . . specialists in solving production problems . . . are available for personal assistance to you. Call us today.

SECO

SECO STEEL MILL EQUIPMENT

- Leveling and Shearing Lines
- Combination Edging and Flattening Lines
- Tension Reels for Strip Polishers
- Narrow Strip Grinding Machines
- Multiple Strand Pull-out Rolls and Take-up Frames
- Strip Coilers (Up and Down Type)
- Traverse Reels for Narrow Strip
- Steel Coil Up-enders
- Scrap Ballers

STEEL EQUIPMENT COMPANY

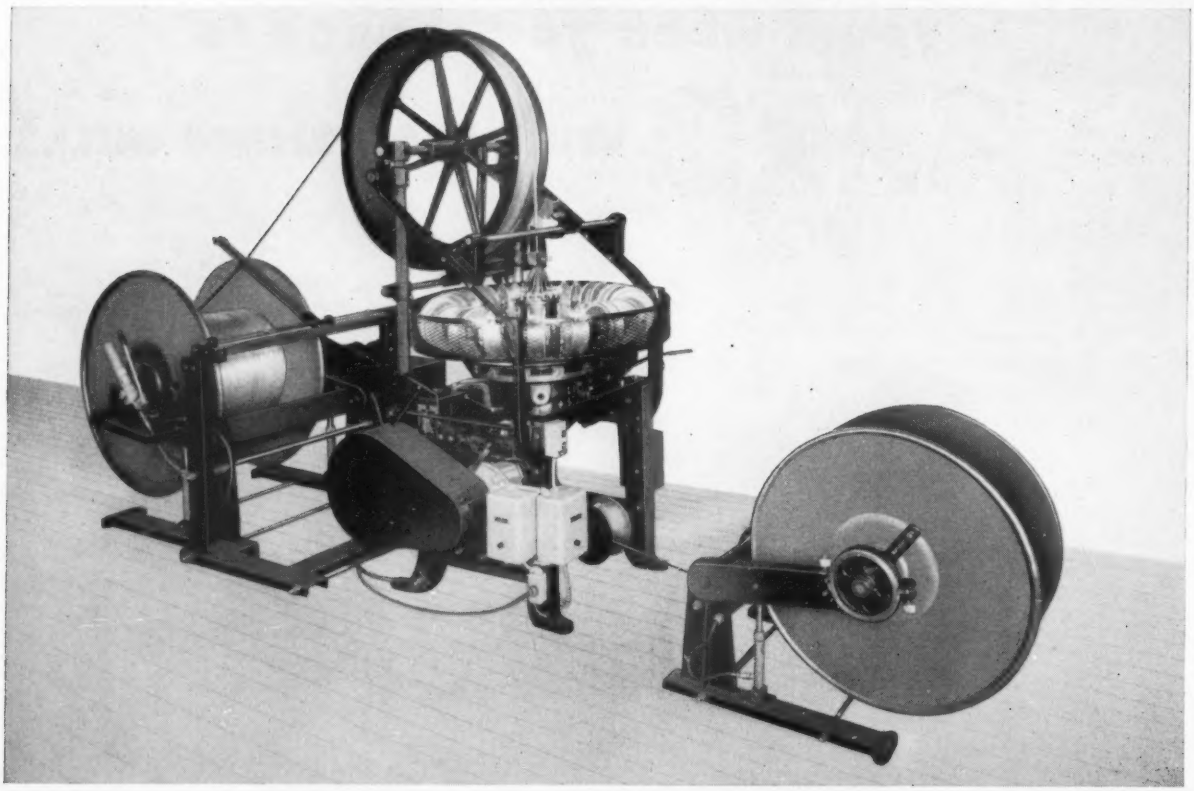
P. O. BOX 737, WARRENSVILLE STATION • CLEVELAND 22, OHIO

AFFILIATED WITH *Lee Wilson* ENGINEERING CO., INC.

New Improved WARDWELLIAN®

MULTIPLE-END ARMOR WIRE SERVER

Applies multiple ends of wire to electrical conductors — for underground distribution cable and other applications



- For production of underground distribution cable, using multiple ends of flat wire, .009 x .047.
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- Machine driven by 2 HP motor, voltage as specified on order. Standard set of twelve change-gears furnished with each machine.
- New design pay off stand and windup stand as illustrated for accommodating reels from 30" to 48" in diameter. Maximum weight of full reel 5000 pounds.
- Reels raised and lowered hydraulically on both pay off stand and windup stands.
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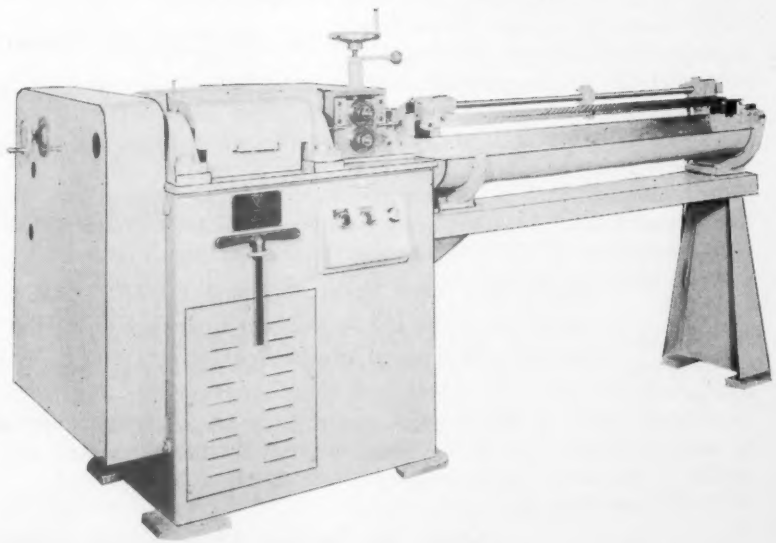

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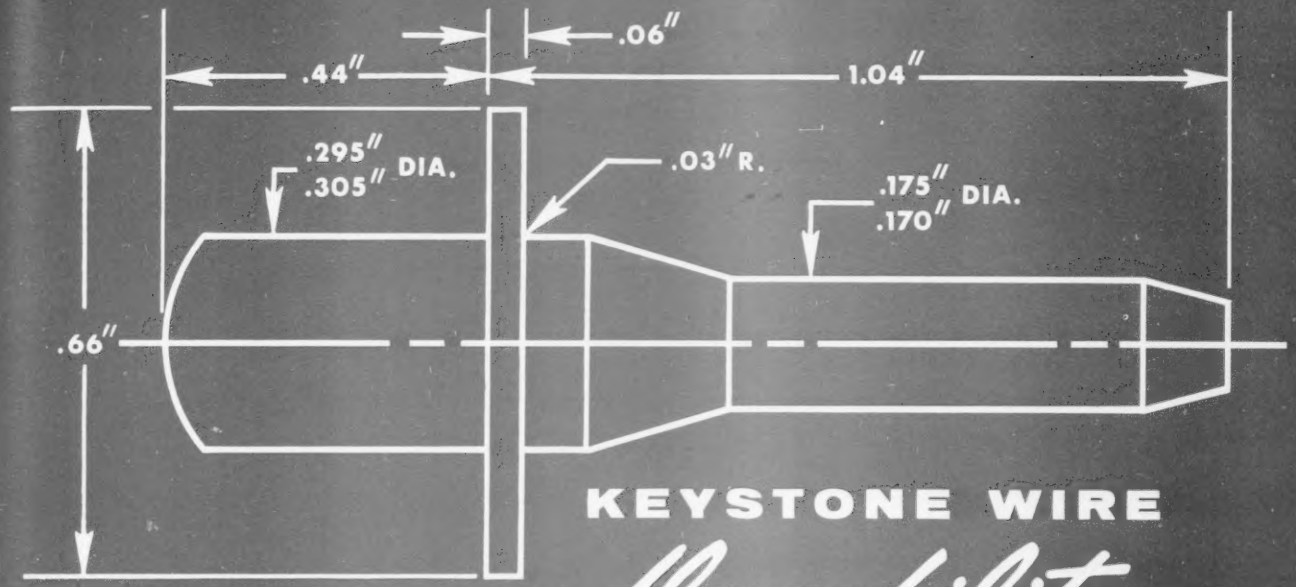

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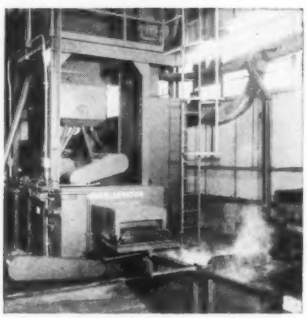

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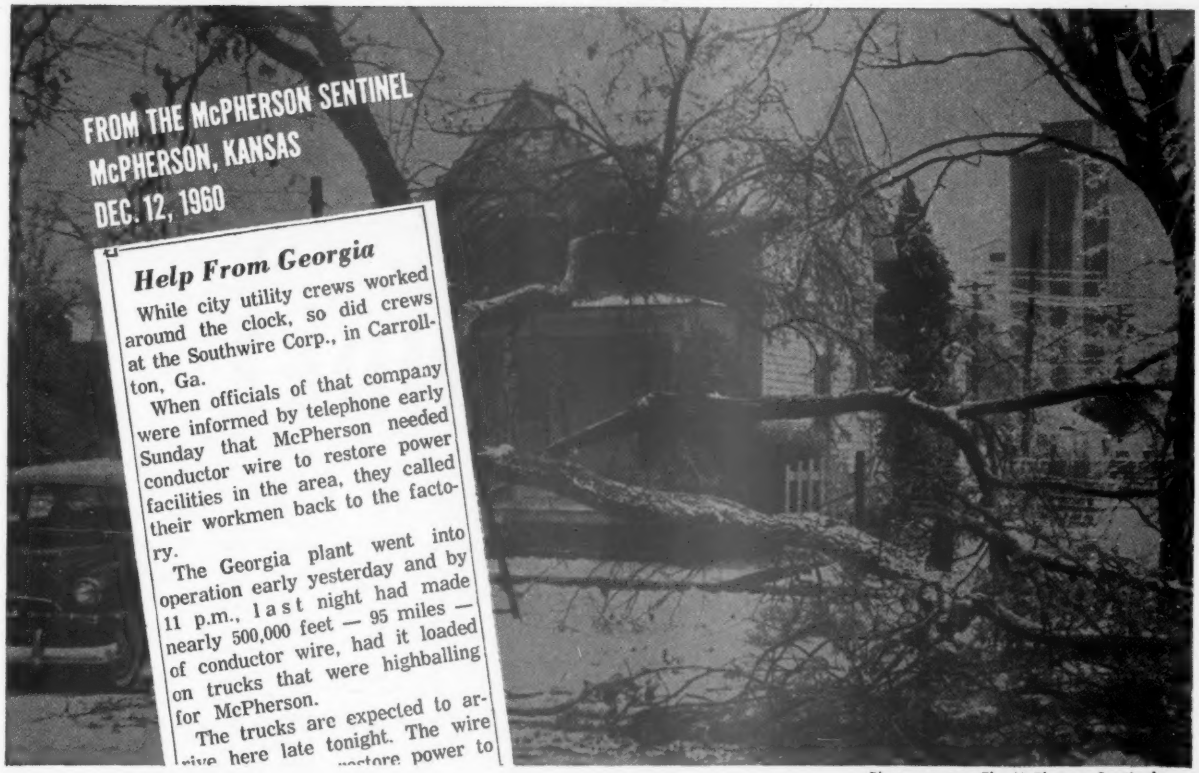
FROM THE McPHERSON SENTINEL
McPHERSON, KANSAS
DEC. 12, 1960
Help From Georgia
While city utility crews worked around the clock, so did crews at the Southwire Corp., in Carrollton, Ga.
When officials of that company were informed by telephone early Sunday that McPherson needed conductor wire to restore power facilities in the area, they called their workmen back to the factory.
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Photo courtesy The McPherson Sentinel

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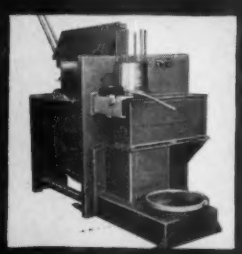

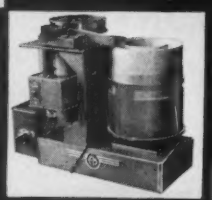

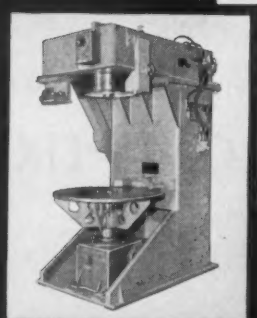

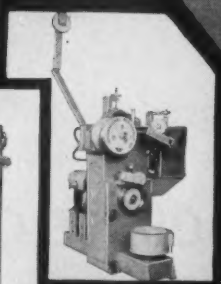

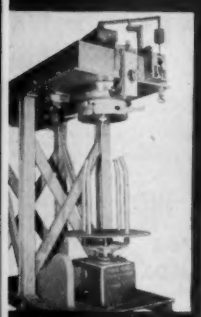

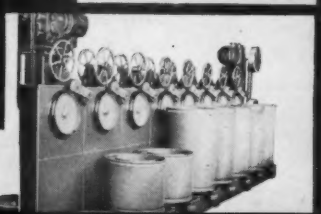

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The Wire Outlook

Unparalleled in the history of any nation are the fiscal outlays of our government.

In addition to carrying a domestic burden of extracurricular projects, some wise and many not, we have assumed many of the burdens of the free world, including both cold wars and the obligation to engage in shooting wars, albeit probably preparation for such latter contingencies cannot be avoided as long as malign forces are on the loose, ambitious to enslave the world.

The question always in the forefront is how far can we extend ourselves and remain solvent as a political and social entity. Certainly with the material debt at astronomical levels and the continued policy of deficit spending, there has to come a point where one more straw of extravagance will break the camel's back.

This last is answered by the old, threadbare gimmick of just raising taxes to meet outlays, regardless of the fact that every dollar extracted from the consumer reduces his purchasing ability and thus narrows the market for the products of industry.

No thought, or at least action, ever appears to be given to the reduction of Federal spending in those many areas in which expenditures should and could be cut—such items as "veteran" benefits, farm price supports, armed forces overlapping services and general wastefulness in those numerous bureaucratic operations without which the country would be better off.

Most of these extravagances were started in the early 30's and continued into the 50's. For an eight year interim a new administration struggled with legislators and entrenched bureaucrats to bring about reforms with but small success. Now, under a new slogan, we have returned to some of the earlier policies that well could lead to the establishment of a welfare state—all of which costs money. To the rank and file it sounds good. Demagogic promises of better times and conditions appeal to the unthinking here, just as the Communist's promises to backward peoples awaken hopes and dreams of a Utopia that never can or will be realized in the foreseeable future.

Nor should the government, whose functions should be confined to political considerations, operate businesses. Its legitimate responsibilities do not encompass competition with its own citizens. Besides paying no taxes and usually operating at a loss, such units (700 of them, we have read) could be more efficiently run by private enterprise.

Many of the policies of the last three decades have been inflationary—such things as gold devaluation, deficit spending, granting to labor monopolies denied to business, etc. Much of this irresponsible and economically ignorant manipulation of the affairs of state accounts directly for the ever decreasing value of the dollar and the placing of home industries at a constantly growing disadvantage in the markets of the world.

The senseless merry-go-round of rising wages and prices seems to have no end. We say "senseless" because with each round of wage or benefit increment, now an annual phenomenon, the "last estate is worse than the first." By the time the cost of living index becomes adjusted to the new wage levels, the worker is right back where he started. On top of this, many workers are displaced by the induced further influx of foreign, low-wage-produced products.

Free trade is a reasonable objective, provided all production is based on comparable wage structures and where goods compete, not on price, but on excellence. It is high time that our legislators and State Department faced the facts of life. Foreign trade both ways is desirable, but is fast becoming a one-way street.

The question that faces every American, whether he be a worker or an executive, is how far we can proceed down the "Roman road to ruin" before we are brought up sharply by the relentless operation of economic laws that have been and are being violated. The "progressive" of today well may be said to be one who retrogresses to policies that in the past have been tried and found wanting.

A day of reckoning will hang over us like the sword of Damocles until some statesman of extraordinary courage, vision and leadership rises in our midst to return the country to those basic principles of minimum government for maximum prosperity. Probably no such leader could be elected while the masses continue to expect something for nothing, but only then can we expect to be economically sound as a nation.

Edmund D. Sickels

EDITOR

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WIRE
AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 36 AUGUST, 1961 No. 8

The Twentieth Century Renaissance in the Steel Wire Industry

by A. M. Reeder
Consulting Engineer
Pittsburgh, Pennsylvania

I recently completed a total of some thirty years service as a Metallurgical Engineer for a large integrated steel mill, most of which was directly associated with rod and wire production and in technical service with the wire trade. I was indeed fortunate in having been so closely associated with an industry in a period when its technological progress was unquestionably greater than in all the previous years of its existence.

* * *

I do not wish to belittle what the years previous to 1930 had accomplished in establishing basic principles for rod and wire production. The wire drawing die was already an old tool, and the continuous wire drawing machine had seen long service although still confined primarily to fine wire drawing. Acid cleaning and lime coating of rods and wire was common practice. It had been noted for years that a rust coat which had been allowed to form immediately after pickling was helpful as a lubricant in wire drawing. This sulcoating, as it was called, was employed extensively in the production of nail wire as well as high carbon spring and rope wire. Since acid inhibitors had not yet been developed, overpickling of the rods and wire was a frequent occurrence, especially with the higher carbon steels, and no doubt sulcoating was quite helpful in reducing the harmful effects in drawing of the overpickled or so called acid burned surface. The principles of the patenting heat treatment were generally recognized long before the nineteen twenties, although the production of wire finer than 13 gage direct from the patented high carbon rod was not considered practical due to the shortcomings in steel quality as well as limitations of wire drawing lubricants and wire drawing dies.

A. M. Reeder

In this article Mr. Reeder has recorded the principal technological advances that he has observed during the last 30 years as a metallurgical engineer for one of the leading steel and wire companies.

Mr. Reeder has been a member of The Wire Association for the last 30 years and has, besides serving on a number of committees, been a director for two three-year terms. He was the Mordica Memorial Lecturer in 1944 at the Annual Convention of The Wire Association held in Pittsburgh.

* * *

My introduction to the Rod and Wire Mills took place in the late nineteen twenties when I was assigned the duties of a Metallurgical Inspector. At least 50% of the dry drawn wire being produced at that time was for application to merchant wire products,—principally nails, barb wire, woven fence, and bale ties. Steel requirements for these items were almost entirely in low carbon basic open hearth or acid bessemer, and in those days merchant wire was considered a good outlet for discards and "off heats" of steel which for various reasons were unsatisfactory for more special applications. The so-called manufacturers' wire of that day was primarily low carbon bright basic and bright bessemer, although by the late nineteen twenties the demand for heading wire and upholstery spring wire was taking on proportions which necessitated a higher order of quality control than heretofore. It was at this particular period that the tungsten carbide die made its appearance, to function as one

of the greatest factors in the renaissance of the wire industry, making possible the present automation in wire production.

* * *

The history of wire records the use of iron and steel wire drawing dies for hundreds of years with apparently little change in design or operation. As wire drawing lubricants were improved and sulcoating and lime coating were brought into practice in wire drawing, die life increased, but not sufficiently to meet the demands of a rapidly expanding wire industry. By the late nineteen twenties the auto industry was beginning to exert considerable pressure on wire production for closer and more uniform wire size tolerances. Automatic high speed machines were being developed for the fabrication of wire products from both low and high carbon wire. In the low carbon field a transition was occurring in the cold heading industry toward the utilization of the solid dies and higher speeds for double blow headers. A little later the heading industry introduced the three and four station heading machines and the process of extrusion in heading for the production of cap screws and hexagon nuts which had heretofore been produced on screw machines from cold finished hexagon bars.

* * *

A growing demand was developing in the automotive as well as in the furniture and bedding fields for upholstery springs of the coiled and knotted type. For years these springs had been produced on hand operated coiling and knotting machines. The rate of production on these machines was slow, and being hand operated they could tolerate considerable variation in both gage and temper of the wire. In the nineteen twenties a large manufacturer of automobile cushion springs began producing his coiled and knotted springs on automatic coilers and knotters, and at a rate of production far greater than on the hand machines. Soon similar machines became popular for production of springs for the furniture and bedding fields. These high speed machines required wire of a much improved order of quality, especially as to uniformity of gage, mechanical properties, finish and cast.

* * *

It was indeed fortunate for the wire industry that the tungsten carbide die should make its appearance at this critical period. Its introduction to wire drawing was a powerful stimulant to the wire industry and sparked a revolution in wire production that is continuing even today.

* * *

A historical reference relative to the origin and first application of the tungsten carbide die is worthy of comment. According to the records, it was the Osram Company, a Krupp affiliate in Germany, which was first to produce tungsten carbide and use it as a substitute for diamond dies in drawing fine wire lamp filaments of various rare metals. This development took place late in the First World War when diamonds were difficult to obtain. Since the hardness of tungsten carbide approached that of the diamond, its value as a die metal for wire drawing was soon to be investigated by wire mills both in Europe and America. As is well known, the die life of this marvelous metal was found to be many times greater than that of the old conventional steel die. The rapidly expanding use of the carbide die not only in the wire mills, but in many other fields, created an unprecedented demand for these dies. Die manufacturers in cooperation with the wire mills were soon to effect economies and improvements in production, which resulted in improved carbide dies for less cost. By the early nineteen thirties most steel wire mills had replaced the old steel die with the carbide type die.

* * *

Continuous dry drawing of wire which had long been retarded for lack of a dependable wire die for holding size, now became commonplace for drawing high carbon as well as low carbon steels. The old single block drawing benches were soon to be replaced by the much more efficient continuous machines, especially for multiple drafting. With improvements in mechanical and electrical controls and better drawing lubricants, notable increases became possible in the speed of drafting the wire, resulting in still greater efficiency. However, it soon became evident that these higher speeds of reduction of the steel, especially in the case of the higher carbon grades, had a harmful effect on certain physical characteristics of the finished wire and particularly on its torsional properties. This deterioration in quality was, of course, the result of excessive heat generated by the higher drawing speeds. To overcome this phenomenon, it was necessary to provide facilities for cooling the wire at various stages during the process of drawing, such as:

(a) Cooling the wire dies by circulation of water in the die block.

(b) Water and air cooling of drawing blocks.

(c) Increasing the amount of wire on each block during the drawing operation.

Such controlled cooling was, of course, found to be of greater necessity with increase in the carbon content of the wire and the speed of drawing.

* * *

With improvements in rod cleaning and wire drawing lubricants, and the use of carbide dies, it became possible to continuously draw much more than a single rod or wire coil without the necessity for a die change. However, this brought on the necessity, especially in continuous wire drawing, for welding the back end of one coil to the front end of the next coil to be drawn. No one doubted the possibility of producing a sufficiently sound weld in low carbon steel that would cold draw through at least four or five dies without breaking. However, there was much skepticism among wire producers that satisfactory welds could be obtained in the higher carbon grades for meeting such drastic requirements. Recognition of the advantages to accrue from welding was undoubtedly responsible for the exhaustive study given this problem. Very soon welding equipment was available which was adaptable to welding all grades of steel. Its success in producing satisfactory welds in the case of high carbon grades, was achieved by providing facilities for

heat treating the weld area immediately following welding. A suitable weld could now be produced continuously with the wire drawing operation. This however, necessitated flipping the rod or wire instead of following the universal practice heretofore of paying it off from a rotating reel. Flipping allowed the back end of the coil being drawn to remain stationary. It was found practical with even the higher carbon grades to draw welds continuously through a series of dies when the total reduction of area amounted to 90% or better. The quality of the metal in the drawn welded area approached that of the parent metal sufficiently to make removal of this area unnecessary in most wire applications. It was now possible to produce the wire in coils of much greater weight than heretofore, and thus the wire mills were able to meet a growing demand for heavier and heavier coils.

* * *

The average weight of a coil of rods rolled on rod mills of the twenties and early thirties was about 300 pounds. Most of these mills were of the straight continuous types. Size range of rods produced was usually 7/32″ to ½″ inclusive. The rod reels were almost universally of the laying type and the rod coils produced were generally of a loose unwieldy shape. The round rod section produced on most of these rod mills was generally of a poor quality, and although there was some attempt to control the character of scale, this feature was not regarded as very important at that time. Overfilling of the rod during rolling was common with the early rod mills, and overfills usually resulted in harmful lap defects, especially detrimental when present in heading or roll threading rods or wire. As was mentioned earlier, the increasing demand for special cold headed parts and for upholstery springs brought automation in the form of the bolt and nut maker for automatic high speed production of the cap screws and hexagon nuts, and the automatic coiling and knotting machine for production of coiled and knotted upholstery springs for the automobile and bedding industries. With this automation came the necessity for better quality rods and wire, especially as to more uniformity of physical and mechanical properties and a surface that would withstand more plastic flow without cracking. In other words, an improvement was in order in both steel making and rod rolling.

* * *

Fortunately for the steel industry at that time, a concentrated study of open hearth slag control in steel making was being conducted under the joint auspices of the Bureau of Mines and Carnegie Institute of Technology, with the cooperation of several large steel mills. This study was to introduce, for the first time, a really scientific control of steel purification in the open hearth furnace, resulting in a notable reduction in such elements as sulphur and oxygen for improved physical properties and rolling characteristics. However, this improvement in steel was not sufficient to overcome the ill effects of a poor rod section or surface defects for which the rod mill was responsible. Recognition of this fact resulted in the construction of new and vastly improved rod mills engineered to produce rods much more accurate as to size and section. In addition, special consideration was given to roll pass design aimed at preventing the formation of harmful laps or other mechanical rod defects. Special equipment was installed for controlled water and air cooling of the rod at the reels. The rod reels installed in these mills produced a much more compact rod coil than was possible with the old mills. They were also capable of rolling a much wider range of rod sizes and considerably heavier coil weights than heretofore. Electrically powered and automatically controlled throughout the rolling from billet to finished rod, these new rod mills have proven their worth in the production of a vastly improved rod product which satisfactorily meets the current high quality requirements of the wire mills.

* * *

While the improvements in rod production in the past several years has been of significant importance, likewise the treatment of the rod preparatory to the wire drawing has undergone some important changes to meet modern wire quality demands. As was mentioned previously, the first significant improvement in scale removal was the addition of an inhibitor to the acid cleaning bath which not only vastly reduced the possibility of overpickling the rod or wire surface, but by forming a blanket on the acid bath reduced harmful acid fumes to a minimum.

* * *

Lime coating the rod or wire coil after acid cleaning has, of course, been a universal practice in wire mills for many years. This lime treatment not only neutralizes any acid that might still be present on the cleaned and washed coil, but when properly dried, acts as a highly efficient carrier for the wire drawing lubricant. However, the presence of a lime coating on wire for some applications has actually been harmful, especially in spot welding or electrical resistance heating. It is well known that lime is a highly efficient electrical insulator and therefore, its presence on the wire surface tends to prevent the necessary electrical contact for electric welding or heating, and often results in harmful arcing. A satisfactory substitute for lime in this case is a coating of a borax salt which reacts chemically with the wire surface to form an adherent coating. This borax treated surface forms a satisfactory lubricant carrier, yet does not exhibit a resistance to the electrical current. Phosphate coatings also are being applied in place of the usual lime coat, especially on heading rods or wire to be used for special cold extruded parts.

* * *

The straight line cleaning house of today is a far cry from the old circular cleaning set-up of the past. The straight cleaning line is equipped with high pressure water sprays and sufficient tubs to accommodate the various types of coating solutions. At the finishing end of the cleaning line is found the flash baker which has replaced the old stationary baking furnace. The flash baker has proven a very rapid and economical method for baking the various types of rod or wire coatings now being used.

Most straight cleaning lines have made no provision for sulcoating of rod or wire since improvements in wire drawing lubricants have eliminated the necessity for the sulcoat. Special **metallic** stearate soaps came into use for drawing heading wire in the early nineteen thirties. The rod in this case is given a fairly heavy lime coat and the ensuing drawn wire finish performs very satisfactorily in such application as production of cap screws in the bolt maker where the shank of the bolt is extruded in one of the header dies. A similar coating has demonstrated its worth on wire for scrapless (cold forged) nut production in the multi-stage nut former.

* * *

A recent innovation in rod cleaning is the mechanical descaling process which is finding increasing application, not only on low carbon steel, but more recently on some high carbon grades. There are two distinct methods in use for mechanical cleaning, namely the mechancial scale breaker type and the shot blasting type. The former was first used extensively in the wire mills of Germany during the Second World War due to a critical shortage of cleaning acid. Efficiency of this method of scale removal was surprisingly much better than anticipated with the result that it is now extensively used for rod cleaning in European Wire Mills. In our country, this method of cleaning has found more popularity with manufacturers using large quantities of wire in only a few grades of steel. Notable examples are manufacturers of flux coated arc welding rods, welded mesh, chain link fence and garment hangers. In such cases, the scale cracking cleaning process is ideal for the following reasons:

(a) The rod can be mechanically cleaned and drawn continuously in the same operation.

(b) The finish and coating required of this wire is not critical.

* * *

The other method for mechanical cleaning is the "shot blasting" process where, as the name implies, fine shot is hurled by mechanical means against the rod surface to accomplish a very complete job of scale removal. This rod cleaning process is being used with considerable success in scale removal of cold heading rods as well as high carbon rods of various types. The shot cleaned rod or wire is usually coated continuously through a solution of lime, phosphate or borax, and can be followed by continuous drawing during this same operation if desired.

* * *

Mention was made previously of the growing trade demand for heavier coils in both rods and wire. Currently this development is in a highly mobile state of flux. Gradual standardization however, can be expected not only as to coil weights but as to dimensional features of the coil, as well as in the realm of coil carriers. At this point, a few comments are in order relative to the change which has been taking place in banding the wire coil. The universal practice of the past was to tie the coils with wire bands usually applied by hand. With the gradual increase in coil weights, this laborious and time consuming task is rapidly being superceded by the use of tying machines that automatically compress and tie the individual coil with the desired number of bands. High strength flat steel bands are employed in place of wire, resulting in a much more secure wire package for resisting the abuse of transportation and rough handling.

* * *

With the acceleration of the wire industry in the early nineteen-thirties, sparked by such important developments as the carbide wire die and the rapidly expanding wire demands in the automotive field, a spirit of cooperation began to replace the secret and individualistic attitudes of the wire producers. There developed a growing feeling that far more was to be gained individually by a comparison of practices and the exchange of ideas on problems of wire production. Conscientious and broad minded representatives of the wire industry, recognizing the beneficial effects to accrue from this desire for open discussion of wire and rod problems are to be thanked for promoting at that time, The Wire Association, whose purpose, as stated in its constitution and by-laws, is **"to improve production methods and afford a clearing house for ideas on management problems, technical problems, and research work in all phases of practical wire drawing and wire working, and to develop and maintain friendly relations among its members".** Undoubtedly, the influence of The Wire Association through its members has played a very significant role in the remarkable accomplishments of the wire industry during the last thirty years, and will continue to be a great influence for progress to the industry in the future years.

* * *

Shortly after The Wire Association had its inception, another agency came into existence which has been a great benefit to the wire industry, namely, the American Iron and Steel Institute's Technical Committee on Rods and Wire. This committee is composed of technical representatives from the nation's steel and wire mills. Among the many important contributions of this committee to the rod and wire industry has been the preparation of a steel products manual covering carbon steel rods and wire. The purpose of this manual is to make available to producers, purchasers, consumers, and all other interested parties highly useful information covering steel rods and wire. Specifically, it deals with tolerances, methods of inspection, sampling and chemical analysis, definitions of technical terms, and other related subjects that have developed in the manufacture and application of rods and wire. Description of the more important wire and rod commodities are included along with information regarding chemical and physical specifications, packaging, end usage, etc. The rod and wire manual has had the noteworthy effect of clarifying, for both the wire manufacturer and his customer, the quality factors that are involved and must be built into each rod and wire commodity. Periodically the wire and rod manual is brought up to date to include descriptions of new commodities and revisions that may be necessary through technical and manufacturing developments in steel and wire.

(*Please turn to page* 1073)

Progress Report on Molybdenum Disulfide as a Copper and Copper Alloy Drawing Lubricant

by Peter M. Magie, Vice President
Bemol, Inc.
Boston, Massachusetts

Previous articles on the use of moly as a lubricant additive have been concerned with its use on ferrous wires. This is the first treatise on its application to the drawing of non-ferrous wires.

Following the recent, widespread success of molybdenum disulfide (moly) as an additive to wet and dry ferrous wire lubricants, a large number of copper and copper alloy mills have conducted considerable production drawing tests with moly. The chief benefits derived from the use of moly have been increased die life, brighter surface finishes, and lower drawing machine power consumption.

* * *

Moly, an extremely low frictional compound, is a lamellar solid, very similar to graphite in appearance. In contrast to graphite, moly possesses frictional coefficients roughly half those of graphite. Also in contrast to graphite, moly shows decreasing frictional coefficients as drawing speeds and die pressures increase.

* * *

One of the early questions posed by the copper and copper alloy mills was the possible reactivity of the two sulphur atoms within the molybdenum disulfide molecule. In practice the sulphur atoms have not been known to react with copper or any of its alloys. The molecule is virtually inert, and no reaction takes place which would cause corrosive action; nor has disassociation ever occurred in controlled annealing furnaces where temperatures may exceed 2000°F.

* * *

Another question was the possible contamination of the wire by moly particles being forced into the surface. In drawing copper base metals in wet lubricants, actual moly concentrations have ranged from 0.02% to 0.15% by weight. Quantitative laboratory analysis performed on copper wire drawn through a 0.15% concentration revealed that residual traces averaged less than ten billionths of an inch. In qualitative diffraction tests these minute traces were found only in occasional pores along the wire surface and were definitely not present as a continuous skin coating. A number of mills have conducted extensive tests to determine if the traces could interfere with the adhesion of poly and epoxy coatings. No interference was reported. It is possible, however, that if strong concentrations were accidentally added to the drawing fluids, interference with adhesion of coatings could occur.

* * *

Because moly powders are insoluble in water and oil, it has been necessary to develop colloidal suspensions of moly particles in both carriers so that additions can be made to water and oil based drawing lubricants. In the suspending process "Pure Moly Powder" is ground to such a fine particle size that the largest particles rarely exceed 0.63 microns in thickness. Thus the particles will readily pass through filter screens. The fine particle size and even distribution of moly in the colloidal suspension account for the very low concentrations needed to produce higher efficiencies in wet drawing fluids. Figure 1 shows the difference between a slurry of "Pure Moly Powder" in water and the colloidal "#110 Suspension" (35% moly suspended in water).

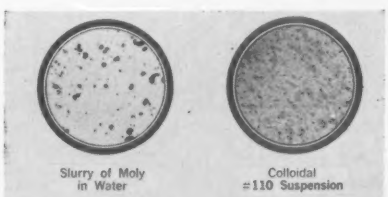

Figure 1 — PHOTOMICROGRAPH COMPARISON OF SLURRY OF MOLY IN WATER TO THE COLLOIDAL #110 SUSPENSION.

Factors Affecting Production Efficiency

The effectiveness of moly in drawing copper based metals has varied greatly from mill to mill. Outside of surface cleanliness, one of the largest variables is the melting point of the particular soap used or, in the case of oil drawing, the reaction temperatures of the additives in the oil. In Figure 2 if we assume that a particular soap has a melting point of 250°F., and that die temperatures are in the immediate proximity of 250°F., only small advantages can be obtained with moly. Usually, however, die temperatures and soap melting point are rarely close, and therefore, moly additions can show substantial increases in drawing efficiency through lowered friction. In this respect, moly becames a useful tool because it acts as an indicator of the efficiency of a soap or oil drawing compound. If extremely large variations occur in die life, amperage, or surface finish, it is evident that other soaps or oils should be used.

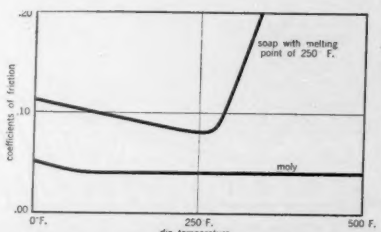

Figure 2 — TYPICAL FRICTIONAL BEHAVIOR OF SOAP COMPOUND AND MOLY.

In water soluble soap and oil drawing, dilution ratios of the colloidal moly additive in the drawing fluid are extremely important in achieving higher production results. Exact dilutions must be determined for each operation in each mill because no one operation is identical to another, even under apparently identical conditions. Production testing should be started by determining die life, amperage, and surface finish prior to the addition of the moly suspension to the drawing fluid. A very weak addition of the moly suspension should then be made, and the three variables should be noted. Step-by-step additions should be made, and die life, amperage and surface finish should be graphically plotted against moly content. Figure 3 gives typical dilution ratios over which testing should be performed. Quite often one or two of the three variables may remain constant, while the third may change substantially. Therefore, it is necessary to observe all three variables as each addition of the moly suspension is made. A typical curve, comparing die life with dilution ratios is shown in Figure 4.

Figure 3. — DILUTION RANGES OVER WHICH TESTING SHOULD BE ACCOMPLISHED.

RATIO OF TOTAL LUBRICANT TO MOLY SUSPENSION BY WEIGHT

Metal	Water Soluble Drawing with #110 Suspension	Oil Drawing with #140 Suspension
copper	1200:1 to 250:1	600:1 to 125:1
brass	800:1 to 150:1	400:1 to 75:1
phosphor bronze	500:1 to 75:1	250:1 to 40:1
beryllium copper	500:1 to 75:1	250:1 to 40:1
cupro-nickel	500:1 to 75:1	250:1 to 40:1

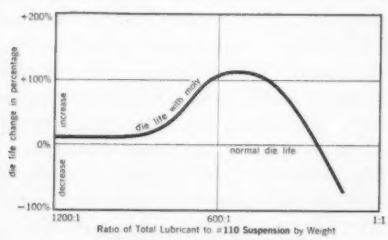

Figure 4. — TYPICAL CURVE SHOWING THE EFFECT OF MOLY CONCENTRATION ON DIE LIFE.

* * *

As the concentration of moly is increased in the drawing lubricant, a typical graph reveals greater efficiency in terms of die life, amperage, and surface finish. After peak efficiency is reached, a drop in die life or an increase in amperage is usually noted. This reversal in efficiency is explained by the fact that too great a moly concentration in the lubricant permits moly to accumulate in the reducing angles of dies faster than it is naturally removed. The die bearing surface is, therefore, starved of free-flowing lubricant and resultant low die life occurs. When this starvation occurs, it is interesting to note that moly can continue to produce excellent surface finishes even though die life may drop severely.

* * *

Another important factor affecting production efficiency is the die reducing angle. Conventional soap and oil based lubricants have considerably lower film strength than the same lubricants containing small amounts of moly. With conventional lubricants, entrance angles must be large so that there will be a minimal contact of wire surface with die surface. See Figure 5. If approach angles are decreased when conventional lubricants are used, the increased contact area results in friction-induced heat which decomposes the lubricant and causes die scoring. Moly lubricants, however, possess greater film strength and are virtually unaffected by heat as is shown in Figure 2. Therefore, die approach angles can be reduced, causing greater contact of die surface with the wire. The increased contact area serves to reduce die pressures and to spread wear over a much greater area, thereby increasing die life. Production research with moly indicates that included approach angles can be reduced by as much as 30% (e.g., from 17° to 12°).

* * *

Reduction of approach angles also minimizes the possibility of excess moly accumulation in the angles which can lead to lowered die life as shown in Figure 4. This factor becomes increasingly important when drawing the harder metals through necessarily higher concentrations of moly.

* * *

One large factor affecting dilution ratios depends on the size of the drawn wire. In drawing large sizes (rod to .125″), slightly stronger concentrations of moly in the drawing lubricant must be used than must be used in drawing fine sizes (.050″ to .0001″). The explanation for the variation in moly content between large, intermediate, and fine sizes lies in the amount of contact area between wire and die. Obviously a large size needs more moly than a fine size because of the difference in contact area. See Figure 6.

Case Reports on Drawing Copper with Moly

CASE #1: In drawing shaved and ultrasonically cleaned 3/8″ and 5/16″ copper rods down to .041″ through carbide and diamond dies, this Eastern mill tested the "#110 Suspen-

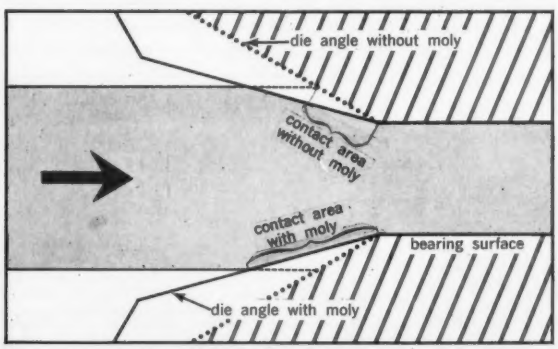

Figure 5. — COMPARISON OF DIE ANGLES WITH AND WITHOUT MOLY IN LUBRICANT, SHOWING HOW MOLY'S FILM STRENGTH PERMITS SPREADING OF LOAD.

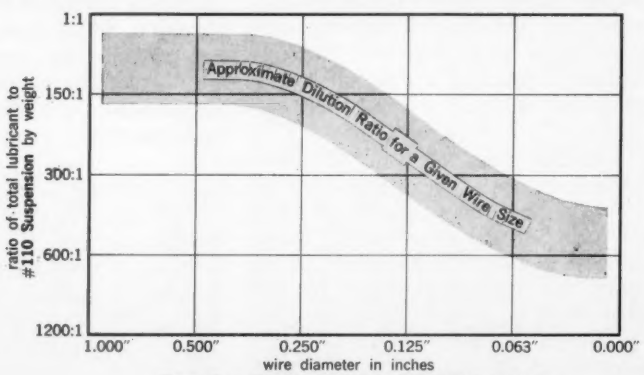

Figure 6. — TYPICAL CHART SHOWING THE EFFECT OF WIRE SIZE ON DILUTION RATIOS.

sion" in both the breakdown drawbox and in the soap solution of their multi-pass machine. No changes were made in the reducing angles. Dilutions were started at a 1400:1 ratio (total lubricant bath to the "#110 Suspension" by weight) at which point no changes were observed. At a 700:1 dilution, amperage dropped 10%, surface finish improved markedly, and die life increased slightly. At subsequent dilutions of 400:1 and 300:1, die life began to fall off slowly and at 200:1 die life dropped suddenly to 33% of its original value. However, improved surface finish and lower amperage readings were observed regardless of the dilution ratio. At all dilutions 5% by weight of the "#110 Suspension" was used in the soap at the breakdown drawbox.

CASE #2: One copper mill, drawing pickled rod down to fine shaped wire through carbide and diamond dies in nine-hole machines, started tests at a 500:1 dilution of the "#140 Suspension" (10% moly colloidally suspended in oil) in a drawing oil; surface finish improved substantially, while die life and amperage remained unchanged. At 300:1, surface finish again improved, die life doubled, and power consumption dropped off 12%. At stronger concentrations of 200:1, 150:1, and 100:1, die life began to return to its original values, although surface finish remained excellent. No changes were made in reducing angles throughout the testing.

CASE #3: In the water soluble soap drawing of copper rod to a finished size of .015" through carbide and diamond dies in multi-pass machines, this mill added 5% of the "#110 Suspension" to the soap in the breakdown drawbox and tested at 1600:1 and 800:1 dilutions of the "#110 Suspension" in the soap solution lubricating subsequent dies; only a slight improvement in surface finish was observed. At 400:1 and 300:1 dilutions, surface finish again improved, while die life increased only 5%. However, at a 250:1 dilution, die life increased 41%, and surface finish was excellent. At 200:1, surface finish and die life began to taper off and testing was halted. Testing now underway with dies with a reducing angle 30% less than normal has led to estimated die life increases over 100% at a 250:1 dilution.

CASE #4: In drawing ½" pickled copper rod through only one hole of a tandem bull block, this firm has taken a different approach to lubrication. The firm filled the drawbox with the undiluted "#110 Suspension." In drawing large wire sizes the company reports increased die life. However, in drawing the finer sizes by the same method, the company reports decreased die life. The reason for this loss in efficiency in the finer sizes was that the very high concentration of moly plugged reducing angles and starved die bearing surfaces of free-flowing lubrication. The company also noted that, by using the "#110 Suspension" undiluted, the wire picked up a slight reddish hue, indicating that heat formed cuprous oxide.

CASE #5: This mill uses moly only for the three sizing and shaving dies prior to the wet drawing of smaller sizes. One percent by weight of the "#110 Suspension" is added to the soap compound in the ripper drawbox. The mill reports that drawing and cutter die life have been lengthened by 50% to 100%. Also noted is a brighter surface finish on the wire during the 21% reduction from ½" rod.

CASE #6: After pickling ⅞" copper rod, this company adds 2.5% by weight "Pure Moly Powder" to a soluble paste in the drawbox of a single-hole bull block. The heavy rod is then drawn down through a carbide die to a finished size of .580". Reported results are a 37% amperage decrease and an improved surface finish on the wire. Die life, however, remained unchanged, and no attempt was made to decrease die reducing angles.

Case Reports on Drawing Brass with Moly

CASE #7: In drawing brass wire from .050" to .007" through 16 dies of a multi-pass machine, a Midwestern mill has experimented with the "#110 Suspension" at only one concentration in a soap drawing bath. The brass wire is not precleaned and proceeds directly to the first die of the drawing machine, which is charged with a 400:1 dilution of the "#110" in the drawing solution. Improved surface finish and a higher polish on the dies has been noted as a result of the moly addition. Experiments are now underway at different dilutions and at smaller die reducing angles.

CASE #8: Another brass mill, starting with .128" wire, draws to finished sizes of .051" to .045" through carbide dies of a nine-hole machine. The "#110 Suspension" is added to the soap paste at the breakdown die only. Dilutions were started at 180:1 by weight and were gradually increased to 25:1. At the 25:1 dilution die life on all dies had increased between 5-7% and surface finish was excellent.

CASE #9: In drawing fine diameter brass wire from .050" down to .002" through diamond dies, one Eastern mill ran preliminary tests with moly without changing approach angles and reported die life increases of 50%. By reducing approach angles 22%, the mill now reports die life increases in excess of 200% by adding small quantities of the "#110 Suspension" to a water soluble soap lubricant. At an 800:1 dilution, only a small improvement in surface finish was noted. At 400:1, surface finish improved markedly and die life more than doubled on all dies of the 11 die machine. At 200:1, die life rose over 200%, while surface finish remained excellent. At dilutions of 150:1 and 100:1, die life and surface finish began to return to normal. At 50:1, die life dropped severely and the wire took on a slight reddish tinge, which showed that excess moly accumulated in the approach angles and allowed heat to form cuprous oxide.

CASE #10: Another brass mill, breaking down rod from ¾" to ½", draws one pass through a drawbox filled with a 20:1 dilution of the "#110 Suspension" in a water soluble soap paste. Before hitting the breakdown die, the moly-soap coating becomes almost completely dry. By this method die life has been increased 28%, amperage has fallen off 18%, and surface finish has gone from fair to excellent. No changes were made in die reducing angles.

CASE #11: One brass mill, in breaking down .625" rod to .450" through a single die bull block, pretreats the cleaned rod by drawing through a preliminary drawbox filled with a 10:1 dilution by weight of the "#110 Suspension" in water. When the rod reaches the breakdown drawbox, the "#110" has dried, leaving a thin film of moly on the rod. The breakdown drawbox is filled with 4% by weight of the "#110 Suspension" in a soap paste. Reported die life increases have ranged from 200% to 300% and surface finish is reported to be excellent. The excess traces left on the wire by the pretreatment procedure are reported to have helped considerably when the wire is redrawn to finer sizes. The mill also noted that drawing amperage dropped, although no measurements were taken. In all drawing the general procedure at this mill is to use smaller entrance angles than normal.

CASE #12: In oil drawing brass wire from .128" down to fine shaped sizes, this mill started testing the "#140 Suspension" at a 400:1 dilution in a drawing oil, and all drawing was done at entrance angles 10% below normal. At 400:1, die life remained unchanged, although surface finish improved. At 300:1, die life increased 100% and surface finish remained excellent. At subsequent dilutions of 200:1 and 125:1, die life and surface finish remained improved, but at a 75:1 dilution, die life and surface finish deterioriated rapidly.

CASE #13: A Midwestern mill drawing ½" brass rod down to fine wire sizes of .005" to .002" has found moly beneficial in extending die life. In testing, the breakdown drawbox was filled with 5% by weight "Pure Moly Powder" in a soap paste. In the multi-pass wet drawing the mill decided on a 200:1 dilution of the "#110 Suspension" in a water diluted soap lubricant. Carbide die life in the larger wire sizes has increased approximately 65%; in the fine sizes diamond die life has increased between 30-40%. Surface finish improved slightly in the large sizes while no improvement was noted in the fine sizes. Testing now underway is being carried out with dies which have reducing angles 25% below normal.

CASE #14: One large mill drawing brass from .045" down to .007" through diamond dies in a water

(*Please turn to page* 1070)

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Address to Electric Wire and Cable Section

by R. J. Nossaman
Director of Design Engineering
Bell Telephone Laboratories
Murray Hill, New Jersey

Mr. Nossaman gave this talk following the plant inspection tour of the Laboratories on April 27, 1961, to the two hundred or so men who had availed themselves of the opportunity to visit the extensive laboratories maintained by the Bell System in Murray Hill, during the 2-day Regional Meeting of the Electric Wire & Cable Section in New York City.

From the name of your organization, I assume that most of you gentlemen have more than an academic interest in wire. I share this interest with you. My own direct experience with wire goes back more than 50 years to the time when barb wire constituted an important part of the economic and social life of the mountain country in which I was raised. Economically, it helped to protect our crop growing areas and to confine our domestic livestock to its proper grazing or feeding grounds. Socially, it served to stop or start arguments among neighbors as to who owned what or whose cattle had gotten into whose hayfield.

* * *

For a few years, my interest in wire languished somewhat and then I found myself in the telephone business which, I soon discovered, uses quite a bit of wire. Since then, much of my time has been spent in activities requiring a very practical and direct association with wire and its many uses.

* * *

During your visit today, you have probably seen only a limited amount of, if any, evidence of activities ordinarily related to or associated with the wire making art. Yet these Laboratories are responsible for the design and development of most of the many types of wire and cable necessary to hook up and energize the largest computer on earth.

* * *

This apparent anomaly can be explained in two ways. One is that most of the development and design of wire for manufacture is carried out by our engineers in Western Electric locations in close collaboration with their Western Electric associates who work out the ways of manufacture and steer production. The other is that the fundamental work done on materials, processes, and studies of characteristics takes place in a number of individual laboratories frequently widely separated and perhaps not individually meaningful to the visitor with limited time.

* * *

Nonetheless, wire is an important part of our lives. Just on the possibility that we have overemphasized this importance to ourselves, I shall give you a few figures and then you can form your own judgments. For example, the copper wire in cables in the Bell System plant amounts to 300 million conductor miles, mostly in gauges from 19 to 26. Let's put it in some other terms. There is enough copper involved to run a band 5 square inches in cross-section around the equator or to make a billet 1 foot square and over 750 miles long. The latter billet would grow, due to new plant, at the rate of more than 50 miles a year, allowing for what is removed from plant and sent back for reworking. So if we put one end of the billet here, the other should about reach Chicago by the end of this year—and won't they be surprised!

* * *

We also use wire in other forms. For example, the Western Electric Company produces and purchases for supply to the Bell Operating Companies about 3½ billion conductor feet annually of rubber covered wire (for purposes of definition, much of this wire is really plastic covered) mainly for use in the outside plant. Of this amount of wire, about 1.5 bcf is in the form of drop wire. Working plant contains over 37,500,000 drops representing about 15 bcf of copper-steel conductor.

* * *

Additionally, the Bell System use of other types of insulated conductor, such as distributing frame wire, switchboard wire, etc., runs to some 10-12 bcf annually and the footage of small gauge enameled wire reaches such a fantastic figure that I hesitate to quote it. Approximately 140 million linear feet of switchboard cable are shipped and installed each year. Also, since the Bell Operating Companies and the Western Electric Company occupy quite a number of buildings here and there, they are fairly good customers of those of you who supply wire and related materials for building and power applications. In addition, the Western purchases and supplies to the Operating Company many types of wired equipment, motors, generators, and so on. Even the wiring in the 90,000 unit vehicular fleet represents a respectable conductor footage. And so far I have not even mentioned the open wire and steel strand which is used with the 20+ million poles in the aerial plant system.

* * *

There are probably many other wire uses in the Bell System that I haven't even thought of, but I trust that the foregoing examples and statistics will suffice to show that the Bell System purchases, produces, and uses a considerable amount of wire and related hardware.

* * *

A word is in order here about the reliability of wire. The average telephone customer requires the services of a repairman about once in two years. Also, the great majority of telephone calls are completed successfully. When one considers the vast mileage of wire and the countless numbers of wire

(*Please turn to page* 1073)

Some Theoretical and Practical Aspects of the Normal Force Effect in Polymeric Liquids and Melts

by

Anthony J. Scalora, Chief
Plastic Research & Development

and

Charles E. Plymale
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Owen-Illinois Glass Company
Toledo, Ohio

Abstract

The normal force effect can be explained by two theoretical approaches—cross viscosity or the fluid elasticity. The fluid elasticity of Weissenberg and others is substantiated by experimental data from several workers.

* * *

The normal force effect has been used by Maxwell to produce a novel plastic extruder which promises to alter conventional plastics extrusion operations. At the present time the areas of pigment dispersion, master batching, and wire coating appear to be the most vulnerable to this new apparatus.

* * *

The screwless or melt elastic extruder which has been popularized by Professor Bryce Maxwell at Princeton University defies the common laws of fluid dynamics. The driving force for this device is a peculiar property of polymeric liquids called the normal force effect. Whenever a Newtonian or near Newtonian liquid such as water is sheared in a rotational viscometer such as the one devised by Mooney, (1) the liquid is thrown from the rotating surface by centrifugal force. If the Newtonian liquid is replaced by a non-Newtonian liquid such as a polymer melt, an opposite effect occurs—a centripetal force which is evident by a rise in pressure from the outside radius to the center. The source of the centripetal force is a debatable subject with at least two schools of thought—the cross viscosity school and the melt elastic school.

This paper was presented by Mr. Plymale at the Regional Meeting of the Electric Wire & Cable Section of The Wire Association on April 28, 1961, in New York City.

Mr. Scalora graduated from Lafayette College in 1949 with a degree of BSChE and secured a MSE (Plastics) from Princeton University in 1958, where his thesis was on Melt Elastic Extruder. Mr. Plymale holds degrees of BA from Marietta College (1958), a BSChE from Case Institute (1958) and a MSE (Plastics) from Princeton (1959). His thesis subject was Separations in Non-Uniform Electric Fields (Dielectrophoresis).

In the melt elasticity school should be placed men such as K. Weissenberg and his co-workers; **S. M. Freeman, Dr. F. J. Russel, J. E. Roberts, F. O. Pollett** and **A. H. Cross, Dr. Melvin Mooney, Dr. W. Philippoff** and his co-workers at Franklin Institute and **Dr. H. Markovitz** at Mellon Institute.

* * *

The early work of **Dr. R. S. Rivilin, Dr. M. Reiner** and others stated that the second order normal forces are due to a cross viscosity effect. The cross viscosity theory predicts that in a rotational viscometer a 0 pressure would exist at R/3 (R=radius) as the following equations indicate (2).

$$\text{Eq. 1.}\quad P_{rr} = -\frac{\Omega^2 (R^2 - r^2) N_c}{2H^2}$$

$$\text{Eq. 2.}\quad P_{zz} = -\frac{\Omega^2 (R^2 - 3r^2) N_c}{2H^2}$$

H = Plate Separation — Horizontal Plates

Ω = Angular Velocity of Moving Plate

Prr = Radial Pressure

Pzz = Verticle Pressure

R = Outer Radius

Nc = Coefficient of Cross Viscosity

r = Variable Radius

* * *

These equations have been experimentally substantiated by Rivlin and Greensmith (3) for polyisobutylene in orthodichlorobenzene. These results have been refuted by **J. E. Roberts** (4). An excellent review of the various theories of secondary forces has been prepared by Dr. Markovitz (5).

* * *

Since much of the experimental evidence to date supports the Weissenberg theory, a brief summary of the assumptions involved in this theory is included. The basic assumption of Weissenberg is that flowing polymer solutions have elastic properties (6). This was first published in 1928 by Weissenberg and Herzog (7) and substantiated by Eisenschitz and Philippoff in 1933 (8). The result of the Weissenberg theory is the following general equation (4).

$$\text{Eq. 3.}\quad \frac{\partial P_{33}}{\partial \ln r} + 2P_{33} - P_{22} - P_{11} = 0$$

r=Variable Radius

P_{33}, P_{22}, P_{11} = Normal Pressures (Figure 1). The Weissenberg theory also requires that

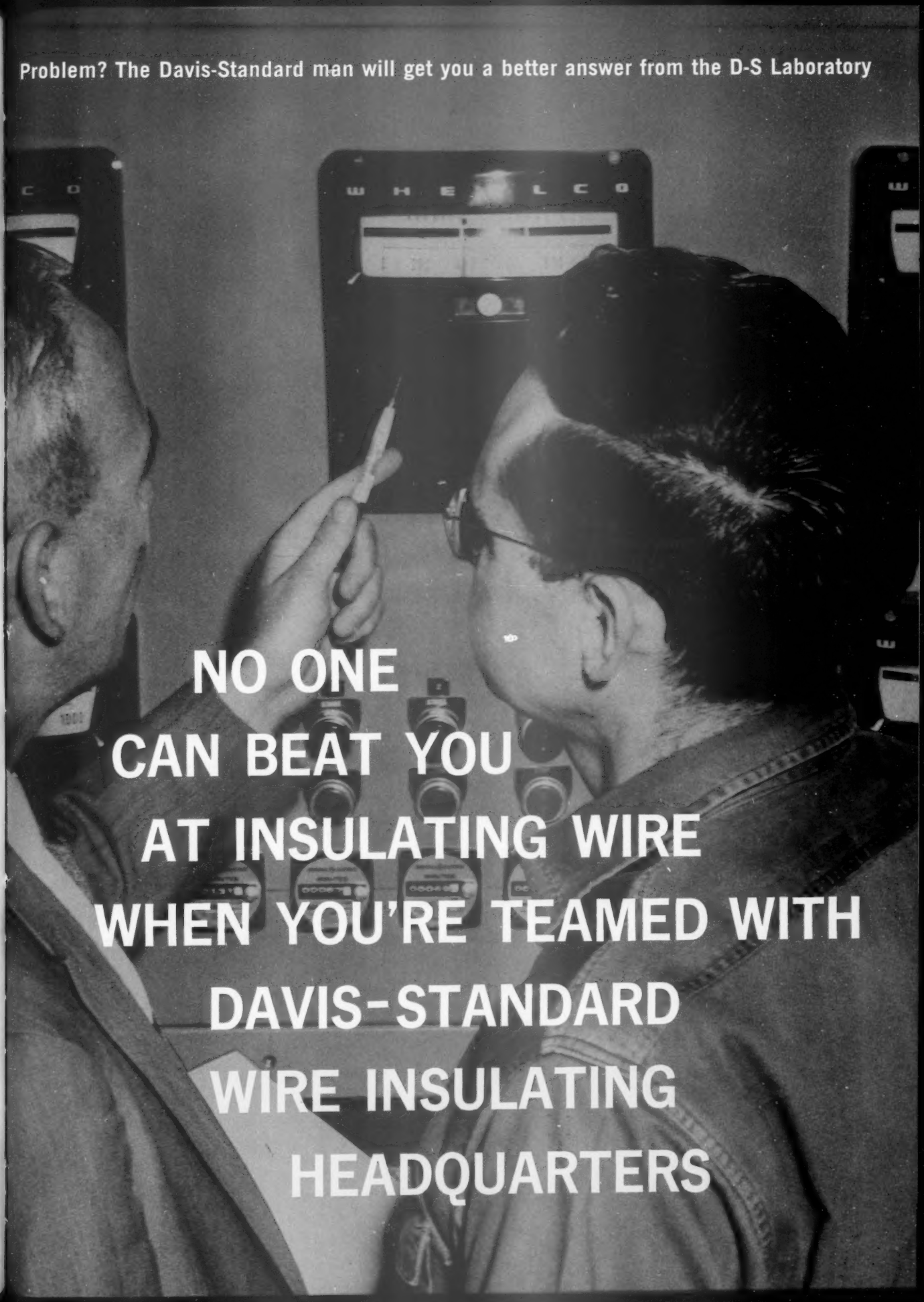
$$P_{22} = P_{33}$$

so that Equation 3 becomes the more familiar form of the Weissenberg theory.

$$\text{Eq. 4.}\quad \frac{\partial P_{33}}{\partial \ln r} = P_{11} - P_{22} = P_{11} - P_{33}$$

Roberts has substantiated (4) the Weissenberg equations by using a

Problem? The Davis-Standard man will get you a better answer from the D-S Laboratory



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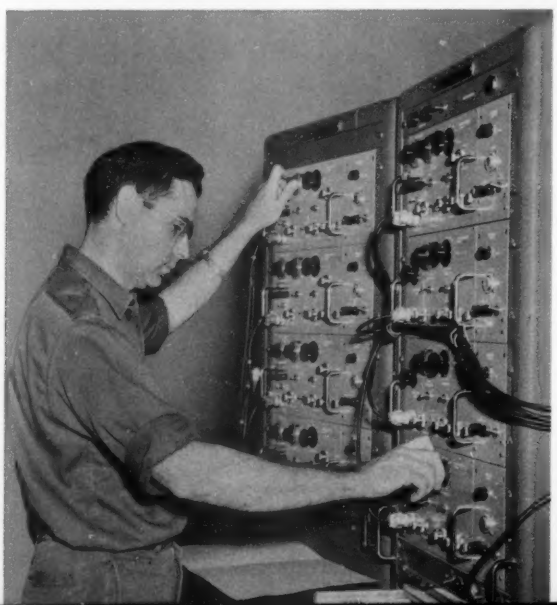
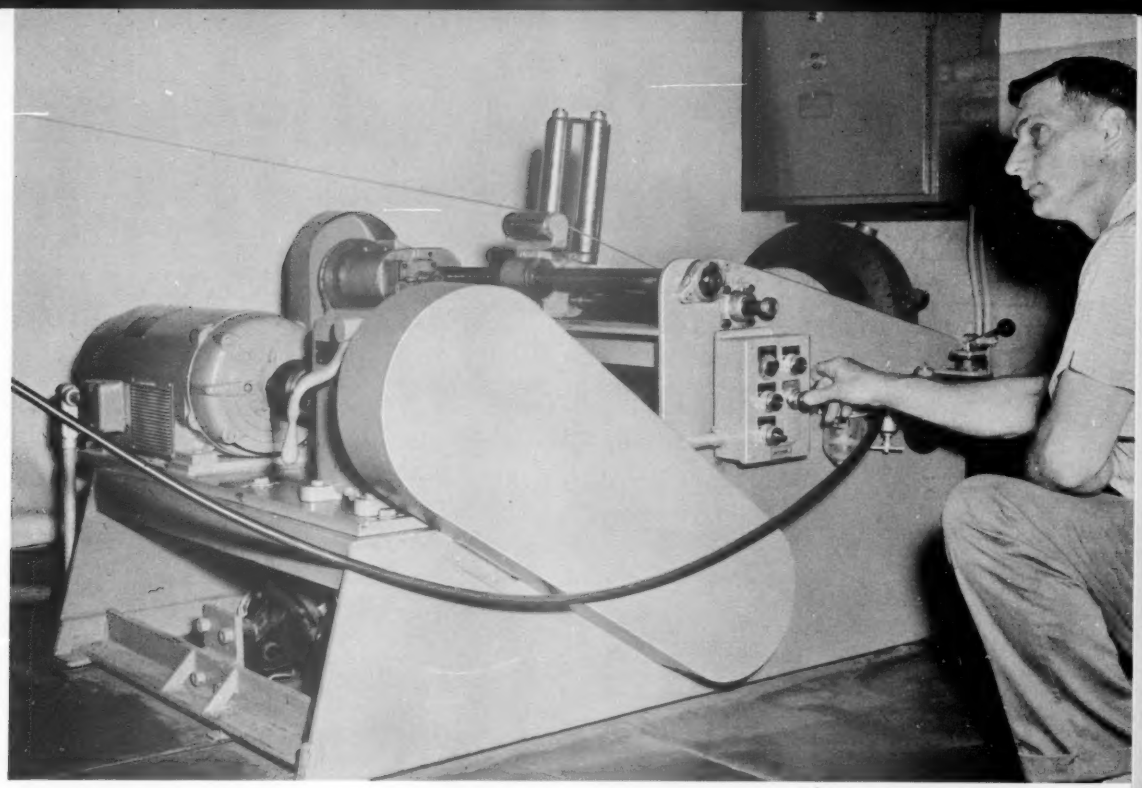


A Continuous eight channel recording of pressure, temperature and motor load

B Continuous take-up with dancer control — ever-increasing take-up speeds require high quality reeling devices with close tolerances designed and tested by Davis-Standard

C Capstan with coordinated drive and take-up dancer tension control

B



ST LABORATORY FACILITIES

What about the new compounds? Could you run them efficiently? What extrusion screw is required? What other problems in handling might they cause? The Davis-Standard man can get you an authoritative answer from the lab. Fact is, many leading formulators come to Mystic to test their new insulating compounds.

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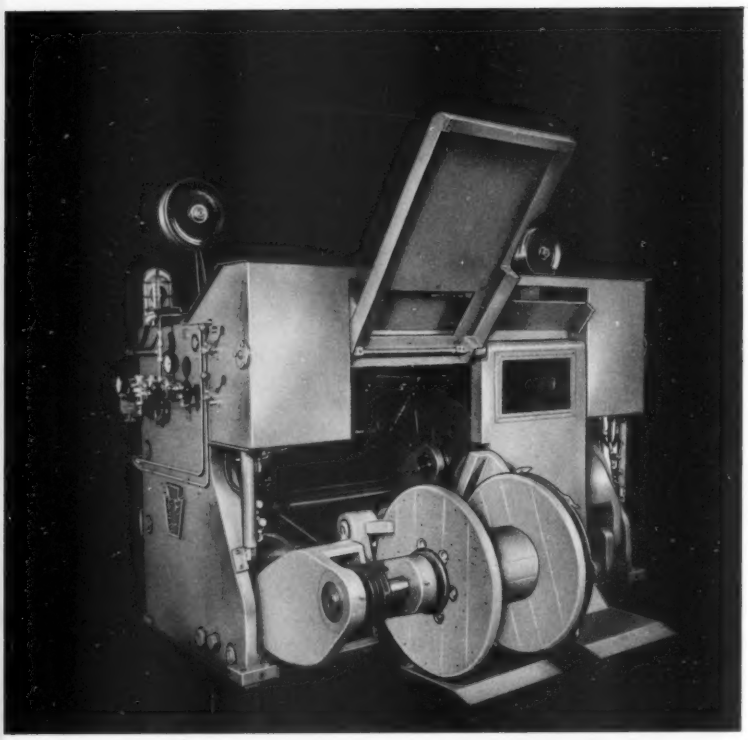
No one can beat you at insulating wire when your wire line has had the benefit of thorough research in the Davis-Standard laboratory.

C

NO ONE CAN BEAT YOU **AT INSULATING WIRE**

WHEN YOU'RE RUNNING WITH A

DAVIS-STANDARD DUAL REEL HIGH SPEED TAKE-UP



A wire line is only as good as its weakest or least productive component. With wire drawing equipment capable of mile-a-minute speeds, wire processing equipment **must not hold it back.** That's why a Davis-Standard high speed dual reel take-up is designed for continuous reeling of lighter gauge insulated wire — #18 AWG and smaller — **at speeds to 4,000 F.P.M.** This take-up is designed for 5,000 F.P.M. speeds. Practical operating range is now over 4,000 F.P.M.

Exclusive features make it possible:

— Pneumatic power handles 24″ reels safely and surely, maintains the proper tension and absorbs shock when switching from full to empty reels.

— Dual motor drive makes sure empty drum is running at wire speed when it's time to cut over. Eddy current adjustable speed motors and automatic braking are controlled by dancer position.

— Patented retractable wire guide insures smooth, more positive crossover from full to empty reel.

Yet your Davis-Standard man can show you a speed capacity of 4,000 F.P.M. is just a figure, with no real value, until that capacity is coordinated.

When teamed with other Davis-Standard components — Matched Components — a high speed dual reel take-up can help you eliminate idle capacity and give you the faster, lower-cost production you need to better your competitive position.

Your Davis-Standard man will **prove** you'll make money with a Matched Component wire line system.

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14 WATER STREET, MYSTIC, CONNECTICUT

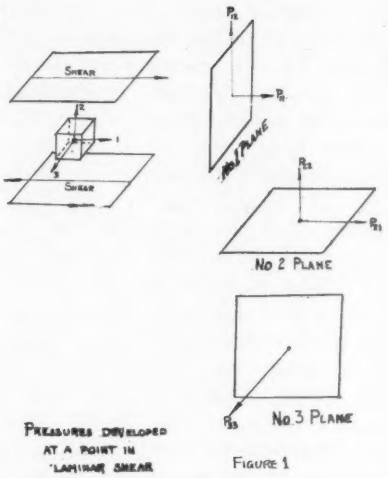


FIGURE 1

Rheogoniometer as seen in figure 2. The various pressures were

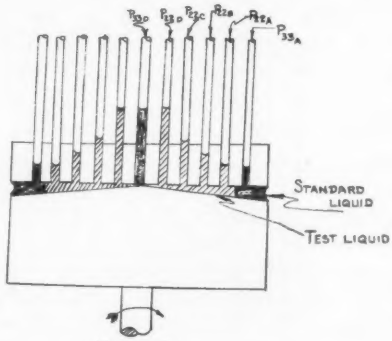


FIGURE 2
SIMPLE RHEOGONIOMETER
ROBERTS METHOD FOR
MEASURING NORMAL FORCES

measured by filling the instrument with a non-Newtonian liquid and a Newtonian liquid. With this combination it is possible to measure P_{22} and P_{33} directly. P_{21} is measured by the torque transmitted to top plate. P_{11} is calculated by assuming the principle of equilibrium of forces is valid. The data assembled by Roberts clearly substantiates Weissenberg's theory for the solutions measured.

* * *

The Weissenberg Rheogoniometer was also used by Pollett and Cross who subjected polyethylene to the same tests as Roberts had used for polymeric liquids. Instead of using capillaries and Newtonian — Non-Newtonian interfaces, the normal force was integrated across the stationary plate and the thrust on the stationary plate was measured. The validity of the Weissenberg assumption of $P_{22}=_{33}$ was confirmed. These experiments and the previous ones of Roberts were conducted under conditions of constant shear rate across the radius of the instrument.

* * *

The quantities actually measured by Pollett and Cross were Ps and Pn.

Eq. 5. $Ps = P_{21}$
Eq. 6. $Pn = 2F/\pi R^2$
Ps = shear stress = torque
Pn = normal stress
F = thrust

Weissenberg's theory (10) also requires that the following equations be satisfied:

Eq. 7. $Ps = Gs$
Eq. 8. $Pn = Gs^2$
G = elastic modulus
S = recoverable shear strain

These equations are used extensively in interpretation of data obtained from the capillary rheometer and birefringence experiments.

* * *

In the United States normal force experiments have been reported by **W. Philippoff** and his co-workers at Franklin Institute. This work is particularly interesting because many experiments were conducted using a birefringence apparatus, a Weissenberg Rheogoniometer, a capillary apparatus and a concentric cylinder apparatus. **Dr. H. Markovitz** is investigating normal forces in an extremely sensitive apparatus at Mellon Institute.

* * *

The foregoing general review of the normal force theories has been included to show the basic concepts involved which have evolved into a practical application—the melt elastic extruder.

* * *

Although the existence of a normal force phenomena has been evident for 35 years, it has remained a laboratory curiosity and a subject of heated debates at rheology meetings. Recently, however, Professor **Bryce Maxwell** and his co-workers at the Princeton University Plastics Laboratory have applied this principle.

* * *

On many conventional extruders, the major part of the heat necessary to plasticate the polymer is provided by conduction from the walls of the extruder barrel and the surfaces of the screw. Polymers, being good thermal insulators, are difficult to heat quickly and uniformly. To provide efficient heat transfer for the extrusion operation, zones along the extruder cylinder are sometimes heated to a temperature which is much greater than the average temperature desired for the material. Material degradation in heat-sensitive polymers will easily occur.

* * *

It would be desirable to minimize the time the hot material is in the extruder and also put as much of the required heat into the material by means of mechanical energy. Since mechanical working will generate heat in the material uniformly throughout the mass as it is being worked, the heating rate will increase and the residence time can be reduced. If it is also necessary to introduce heat by conduction, the cross-sectional distance that the heat must travel through the polymer should be reduced to a minimum.

* * *

Another problem which sometimes occurs in the screw extruder is the fluctuation of pressure at the die. In order to achieve steadystate conditions at high throughput rates, careful consideration must be given to the design of the screw for each type of material. Pressure fluctuations can result if screws are operated under operating conditions for which they were not designed or with materials with characteristics not suitable for a particular screw design.

* * *

Adaptation of the normal force phenomena to the extrusion of polymers became a reality in the shear apparatus built by Maxwell. All previous displays of normal force were made in dilute solutions of polymers. The question became "Can it be accomplished on polymer melts?" Maxwell's melt elastic extruder consisted of a rotating plate and a stationary plate with a hole in the center for polymer effulent. Heating was applied to the apparatus and low density polyethylene was

extruded.

* * *

The initial operation gave good indications of a reasonably efficient plasticizing machine possessing many advantages over conventional present-day extruders. Advantages expected were: material heating provided by mechanical working, low residence times in the extruder, more uniform heating of the material and no possible appearance of pulsations in material flow.

* * *

Figure 3 (11) shows the apparatus required to demonstrate the normal force effect operating in a vertical position. In order to eliminate the gravity head from measurements and to assist in feeding material, the apparatus used for this study was operated horizontally. This has no effect on the basic principle.

* * *

As was stated previously, the actual driving force for the normal force phenomena is uncertain; however, the Figure 4 may be helpful in understanding the driving force in this new extrusion technique. Let X_1 represent a point on the bottom surface of the rotating disk and Y represent a point on the inner surface of the bottom of the fixed cup, directly below X_1 at any given instant of time. Then at some time later, X_1 will have moved to some position X_2 along the curved path X_1–X_2. Assuming that the liquid E adheres to the surfaces at X_1 and Y, and that the liquid is partially elastic, then it will be stretched along the straight path X_1—X_2. In one sense, the elastic behavior of the liquid is like the stretching of a rubber band along the curved path X_1–X_2, and the tendency for elastic recovery gives rise to a force toward the center of rotation represented by the arrow Z. This force toward the center of rotation, or centripetal force, which is generated in, and acts on the material, gives rise to a pressure between the cup and the rotating disk. This pressure acting in the gap creates the normal force tending to separate the plates.

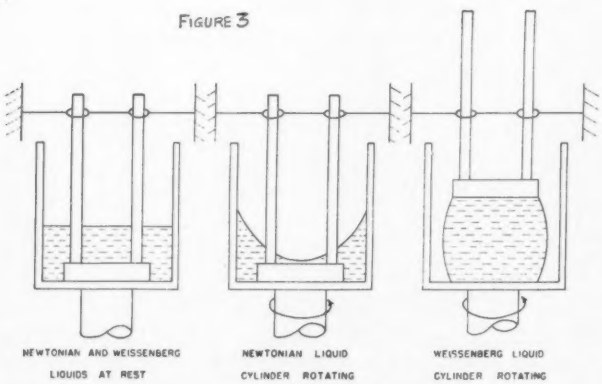
* * *

The centripetal force Z gives rise to a centripetal flow. Since the entire area under the rotating disk contributes to the centripetal pumping action, the material through-put of the extruder is not limited by the pressure developed but rather by the centripetal pumping action itself. From the rubber band analogy it becomes apparent that the proper combination of elastic and viscous response, and the wetability of the surfaces of the disk and cup by the liquid is necessary for extrusion by this method. The greater the elastic character of the liquid, the greater the centripetal pumping action. The lower the apparent viscosity of the liquid, the less restriction there will be to the flow of the material. For this reason the method of extrusion described here is called elastic melt extrusion or rheolastic extrusion.

* * *

The actual Maxwell extruder is shown in Figure 5 where the side view is a vertical section through the axis of rotation of the disk or bob. Section AA shows a vertical section perpendicular to the axis of rotation. A 1-hp. a.-c. motor coupled to the bob through reduction pulleys was used to drive the disk. Heating was provided by electrical resistance heater bands clamped on the exterior of the case. The feed tube or "hopper" was cooled by water circulating in a cooling coil. For these conditions of operation, more heat was generated by mechanical working than was desired, so cooling water was also circulated in channels in the case. Temperatures were measured by using a thermocouple and recording potentiometer with the thermocouple

FIGURE 3


NEWTONIAN AND WEISSENBERG LIQUIDS AT REST
NEWTONIAN LIQUID CYLINDER ROTATING
WEISSENBERG LIQUID CYLINDER ROTATING

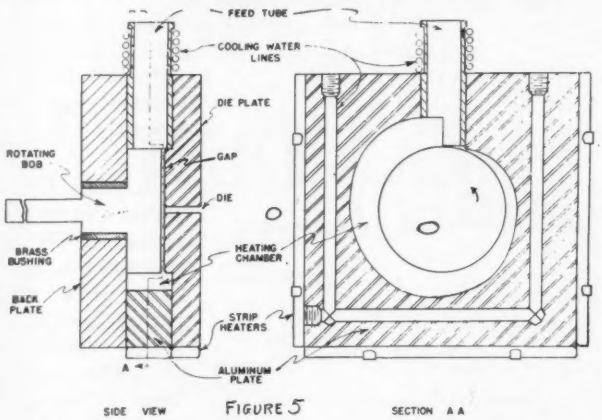


FIGURE 5

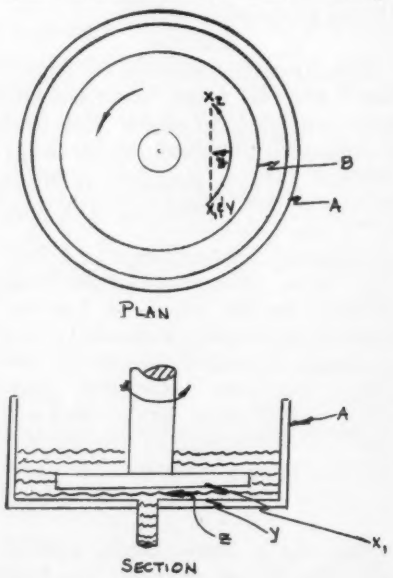


FIGURE 4
SCHEMATIC OF NORMAL FORCE

located as close as possible to the melt shearing zone in the die plate. Power input was determined with a watt-meter.

* * *

The heating chamber, or melt reservoir, was constructed in three parts. A 6-in. diameter circular back plate served as the rear wall of the heating chamber and also as the bearing mounting for the rotating bob. The side wall of the chamber was made from an aluminum plate. The shape of the heating chamber was such as to produce a convolute spiral around the bob for the purpose of feeding polymer into the shearing zone. A third circular die plate formed the front wall of the heating chamber and also acted as the stationary shearing surface and the extrusion die. The disk was 2 3/4 in. diameter.

* * *

Operation was begun by applying heat to the apparatus to attain a temperature above the softening point of the polymer. During the heating period, polymer granules were placed in the heating chamber. When the granules had softened, the extruder was started. Polymer granules were fed continuously through the hopper.

* * *

By adjusting the power supplied to the heaters and controlling the cooling water, the desired operating temperature was established and maintained. Enough polymer was continually added to keep a rolling bank of melt in the bottom of the feed tube and the time to collect the extrudate was recorded. The power consumed by the drive motor was measured during each run at a time when no solid granules were in the melt reservoir; however a rolling bank of melt covering at least 3/4 of the bottom area of the feed tube was carefully maintained. This procedure was chosen so that constant readings could be obtained. If solid granules were present in the shearing zone, abnormally high, irregular readings would have occurred. It should be pointed out that in the device shown in Figure 5, it is possible for polymer melt to be forced by the feed system back into the area between the back of the rotating bob and the back plate and from there into the bushing.

* * *

The design presented in Figure 5 was selected as being a simple device with which to study the effect of the variables of r.p.m., temperature and gap size. Based on the results above, the original design has been improved, particularly with respect to the feed zone and the restriction of flow in the gap. Figure 6 presents a cross-section drawing and photographs of the improved design. Here the face of the rotor is a truncated cone, the side of which forms an annular feed zone of a triangular cross-section with the wall of the heating chamber. As the granules fall into the feed zone from the feed tube, they are forced into the shearing zone and no spiral or converging feed system is needed. With no positive pressure built up in the outer portion of the feed zone, leakage back over the clearance between the rotor and the supporting case is no problem.

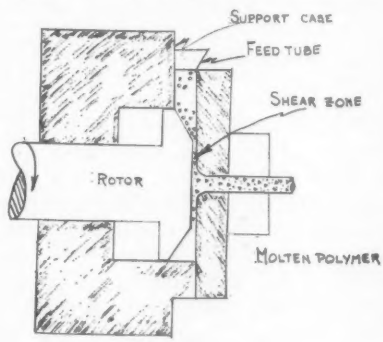


FIGURE 6
IMPROVED MELT-ELASTIC EXTRUSION APPARATUS

* * *

The shearing face of the rotor is contoured to give an increasing gap with decreasing radius. Thus, the shape of the rotor can be designed to reduce the restriction to flow and to produce any desired compression ratio. The extruder of Figure 6 was designed with an area in the die cross-section that was 10% less than the area of the annular plane at the outermost part of the shearing zone, C. This design also had a mechanism for moving the rotor along its axis of rotation to adjust the gap size during operation and was a satisfactory design for studying the elastic melt extrusion characteristics of several different plastics. Table 1 lists the various materials that were extruded. In general powder or flake feeds more easily than granules. Polyethylene pellets can be easily handled but at a slight increase in power consumption.

* * *

The results of a series of tests using branched polyethylene (M.I. 0.2-21.0) density 0.92 are shown in Figures 7, 8, 9, and 10.

* * *

Figure 7 shows the output versus temperature with a 1/8 inch diameter by 1/2 inch long die opening. The same general trend of increased output with increased temperature and speed is noted at gaps of 1/16 and 1/8 inch.

* * *

Table 1

Materials Tried in New Extruder

Material	*Form of Feed*
Low-density polyethylene	Flake or granules
High-density polyethylene	Flake or granules
High-impact polystyrene	Granules
Polymethyl methacrylate	Granules
Plasticized polyvinyl chloride	Granules
Polypropylene	Flake or granules
Cellulose acetate	Granules
Foam polystyrene	Beads
Carbon black-filled polyethylene	Powder dry blend
Cross-linked polyethylene	Dry Blend

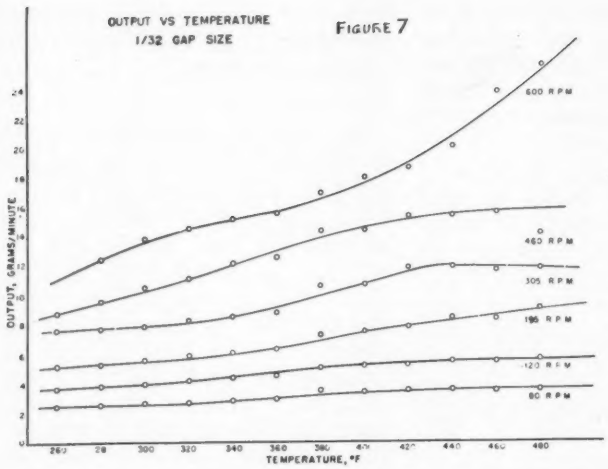


FIGURE 7

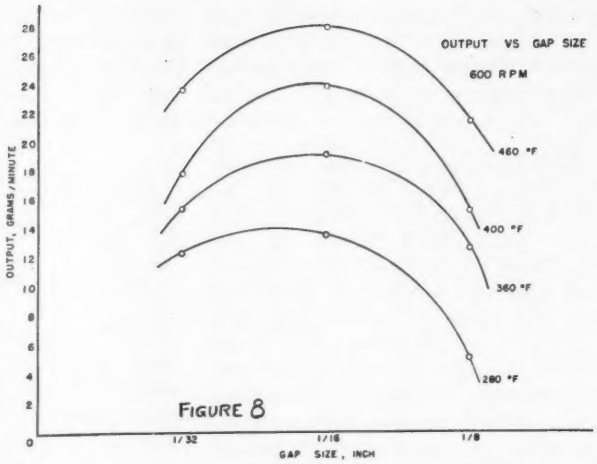


FIGURE 8

As the temperature of the polymer melt is increased, two changes in the mechanical response of the material occur simultaneously. The elastic response and viscosity are both decreasing. Since the centripetal pumping action of the normal force effect is dependent on the elastic response and is retarded by the viscous response, it is apparent from Figure 7 that the decrease in viscosity is predominant over the decrease in elastic response in the range studied. At temperatures above 500°F., it would be expected that even the high r.p.m. curves would level off or perhaps decrease as the melt approached the character of a purely viscous liquid.

* * *

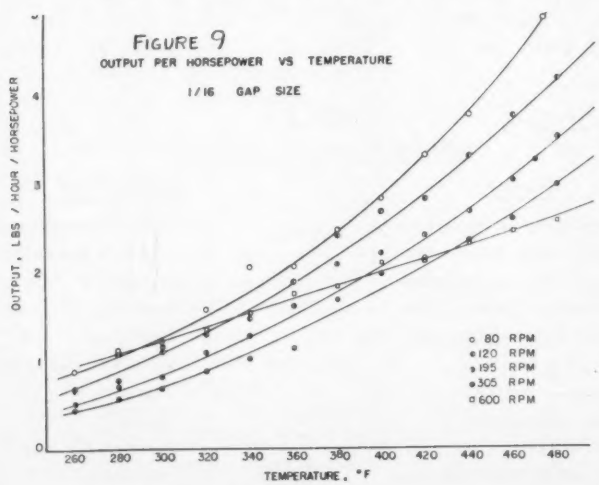
The effect of gap size on output at various temperatures at 600 r.p.m. is shown in Figure 8. At each temperature there is an optimum gap size for maximum output. This is consistent with the picture of the centripetal pumping action presented in Figure 4. For small gap sizes the normal force effect is high but the centripetal flow is strongly restricted by the small space between the rotor and the face plate. As the gap size is increased the pumping action is still strong and the flow is less restricted, hence output increases. Above some limiting value of gap size the normal force decreases since the distance between X_1 and Y (Figure 4) become too great for the elastic behavior to be prominent and the output decreases.

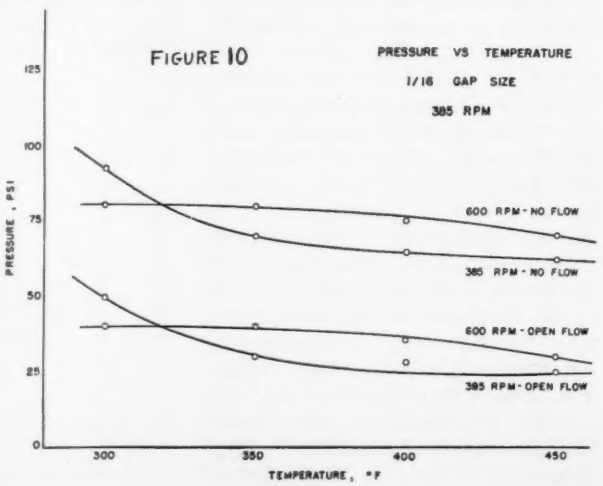
* * *

Power consumption as a function of temperature and r.p.m. is shown in Figure 9, for a 1/16-in. gap size. There is a trend toward greater output/hr./hp. with increased temperature at all rotational speeds. Since flow through the die is restricted, this trend is consistent with the reduction in apparent viscosity to be expected at increased temperatures. The greatest efficiency with respect to the drive power is found at the lowest speed (80 rpm). Since the horsepower listed is the power consumed by the motor and since more heat must be supplied by the strip heaters at low r.p.m., it would be reasonable to expect that greater efficiency would be found at lower speeds. This same trend was found for both 1/32- and 1/8-in. gap sizes.

* * *

Although determinations of the normal force in liquids and solutions have been under no-flow conditions, it is not possible to use such data for predictions of pressures developed during elas-





tic melt extrusions. Flow is now taking place through the device and the normal force effect due to the shearing of bulk polymers has not been studied.

* * *

Some direct measurements of the pressure developed during the elastic melt extrusion were made using a silicone grease filled bourdon tube attached to the extrusion die. The results are presented in Figure 10. These pressures are very low when compared to those developed in conventional screw extruders. However, the laboratory model on which these measurements were made is relatively small compared to conventional extruders. No prediction can be made as to what pressures could be developed by this method until reliable information is obtained on the effect of rotor diameter and other scale-up factors. Since the extrusion pump and the forming die are contiguous in this elastic melt extruder, pressure is not the controlling factor in extrusion rate.

* * *

Residence time, often a prime cause of heat degradation, is reduced markedly by this extrusion process. Residence times ranging from 50 sec. down to less than 9 sec. have been measured using this elastic melt machine as compared with minutes in the conventional screw extruder. These short times are important in processing heat-sensitive materials.

* * *

The gap distance between the rotating bob and the die plate shown in Figure 5 is constant across the radius. This means that the area of any annular plane parallel to the axis of rotation in the shearing zone will vary with the radius.

* * *

As a result, the flow of material is progressively restricted as it passes through planes of diminishing radii and approaches the die. Conversely, as the die diameter is increased and reduces the length of the shearing zone, restriction is reduced. By using a 3/8-in. diameter entrance to the 1/8-in. diameter shaping die, output rates of 6.5 lb/hr/hp. have been measured. It is evident that a coordinated design of the gap cross-section and die inlet can produce marked improvements in output rate. A machine based on the work presented here has been built by another laboratory and output rates of over 12 lb/hr have been achieved with a 1-hp. drive.

* * *

Although high-impact polystyrene and polymethyl methacrylate are in glassy state at room temperature, the elastic melt extruder was found to work equally well with these materials. The plastication of these hard granules is promoted by direct contact with the hot, rolling bank of polymer melt in the feed zone.

* * *

Plasticized polyvinyl chloride and polypropylene are two examples of materials which are ideally suited for this device. Both exhibit a high degree of elasticity when in the melt state and the centripetal pumping action is very positive. In addition, melts of both these materials are very tacky and adhere to the surfaces of the rotor and stationary plate, which also promotes the elastic melt effect.

* * *

With all materials, controlling the compression ratio, by changing gap size or rotor contour, allows one to control the degree of degassing that takes place.

* * *

To demonstrate this, polystyrene beads containing a foaming agent were fed into the elastic melt extruder. With a large gap and, therefore, low compression, low-density foams, having well-dispersed bubbles of uniform size, can be extruded. In addition, no difficulty was encountered with material flowing back into the feed tube or hopper due to the foaming action. If the gap is reduced, thus increasing the compression ratio, the foaming gas may be completely removed from the melt with the result that bubble-free polystyrene extrusions result. By this method it should be possible to control foam density by controlling the extraction of volatiles. Similarly, cellulose acetate can be extruded without being preheated to remove water.

* * *

As mentioned earlier, extruders are used for mixing, compounding, and dispersing. In the shearing or pumping zone of the elastic melt extruder, the material receives the highly uniform, intensive shearing required for good mixing and dispersion. Dry blends of polyethylene containing 1 to 50% carbon black have been processed in this extruder (12). Microscopic examination indicates good background with some agglomerates even though the residence time was less than 10 seconds. Further improvements in dispersion can be achieved with multiple passes.

* * *

Polyethylene can be cross-linked by dicumyl peroxide at elevated temperatures (13). As the cross-linking reaction takes place the melt should become progressively more elastic. Such a reaction taking place in the elastic melt extruder would tend to increase the pumping of material through the extruder rather than the stopping of flow that would take place in a conventional screw extruder. That is, the more cross-linking that takes place the more anxious the material is to come out of the elastic melt extruder. This is true with dry blends of both linear and branched polyethylenes of both high and low molecular weight. Peroxide concentrations from 1 to 2 1/2% by weight have been used. It is possible to control the extrusion conditions so that cure is complete in the hot extrudate within a few inches after leaving the die.

* * *

The flow pattern in the elastic melt extruder is such that polymer melt is pumped toward the die from all directions. Since the axial length of the device is relatively short compared to the conventional screw extruder it appears possible to coat wire by feeding the conductor directly through a hole along the axis of

(*Please turn to page* 1068)

Regional Meeting in San Francisco Draws Good Attendance

San Francisco, California, was the locale of the West Coast Regional Meeting of The Wire Association in 1961. Held at the new Jack Tar Hotel on June 22nd and 23rd, the meeting drew approximately 150 persons, mostly from the area.

* * *

The registration of members and guests started at 10 o'clock on the morning of June 22nd with the technical session being held in the afternoon, at which five technical papers were presented.

Technical Session

W. H. Fish, Assistant Manager of Wire Sales, Pacific Coast Division of The Colorado Fuel & Iron Corp., served as Moderator, introducing the speakers and their subjects.

* * *

Robert F. Carmody, Industrial Engineer, and K. R. Miller, Regional Sales Manager, Preformed Line Products Co., Palo Alto, Cal., were responsible for a paper "A Unique and Unusual Use of Wire", describing the company's products for telephone and power line wire.

* * *

"Roll Threading of Fasteners" was the subject of a talk by **Richard Bell,** Superintendent, Bolt Plant, Bethlehem Steel Co., South San Francisco, Cal. This related to production activities that were to be seen in the plant tour on the following day.

* * *

Hal McVey, Northern California Sales Manager, Connor Spring Company, San Francisco, presented a paper on the subject of springs, entitled "Importance of Wire in Spring Design".

* * *

John O. Todd, Jr., Special Representative, Distribution Division, Western Region, International Business Machines, Los Angeles, Cal., next gave a talk, "Introduction to Inventory Management for the Distributor."

* * *

Another paper, by **Kenneth P. Brown,** The Techalloy Co., Inc., Pocoima, Cal., was devoted to the subject of "Coatings on Stainless Steel and High Nickel Alloy Wires."

* * *

The papers aroused considerable interest and the session was the more interesting due to the very able leadership of Mr. Fish.

Plant Inspection Tour

On Friday, June 23, 100 persons went through the Bolt Plant of the Bethlehem Steel Company's South San Francisco works. This tour proved to be informative and interesting to all who took it in.

* * *

After the trip through the plant, the group was taken to the International Inn in South San Francisco for luncheon, following which they returned to the hotel via the scenic Coast Highway.

The Dinner

On Friday evening some 145 persons gathered for a friendly Hospitality Hour as the guests of **Bethlehem Steel Company, The Colorado Fuel & Iron Corporation, Columbia-Geneva Steel Division** of U. S. Steel Corp., **Planett Manufacturing Company, John A. Roebling's Sons Division** of C. F. & I., and the **Wire Specialties Co.**

* * *

Dinner followed at 7:30 p.m., after which a large number of attractive door prizes supplied by various companies were presented to the fortunate ticket holders.

* * *

The principal speaker was Kern Y. Loo, Manager of the Chinatown Telephone Exchange in San Francisco, who gave a very interesting and informative talk on Chinese life, on the establishment of the Chinese Telephone Company and on the method of training operators. His talk was entitled "The History of the Chinatown Telephone Exchange." The dinner program concluded the two-day meeting.

* * *

Chiefly responsible for this excellent meeting was **Robert W. Payne,** Distribution Assistant, Wire Product Sales, Columbia-Geneva Steel Div., U. S. Steel Corp., who was Chairman of the Program Committee. Members of the Committee were:

T. C. Cullinan, Met. Eng.
Bethlehem Steel Co.
Pacific Coast Div.

D. H. Kofahl, Sales Rep.
Pacific Coast Division
The Colorado Fuel & Iron Corp.

L. H. Lee, Asst. Prod. Sales Mgr.
Wire & Hardware Products
Pacific Coast Division
The Colorado Fuel & Iron Corp.

J. L. Phillips, Salesman
Bethlehem Steel Corp.
Pacific Coast Div.

* * *

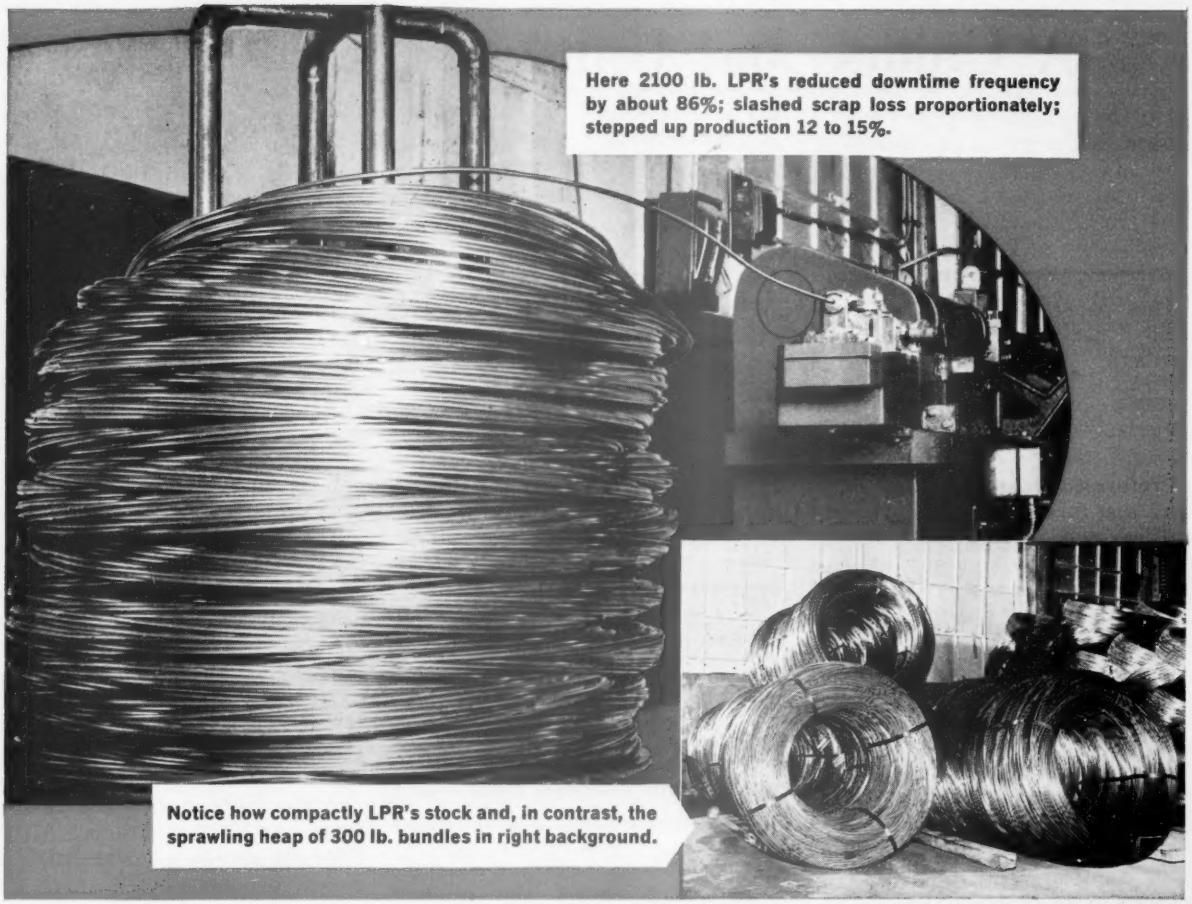
Hats are off to these gentlemen and to Mr. Fish, Moderator of the Technical Session, for their months of hard work in planning the details of the meeting so well.

* * *

Mr. Payne had been co-moderator of the Technical Session with V. A. Barbata of Bethlehem Steel at the meeting held in 1959 in San Francisco. A former member of Bethlehem's Metallurgical Department, he was transferred to the General Sales Department in 1950 to handle Wire and Wire Products.

* * *

Papers presented at the meeting are printed elsewhere in this issue of **Wire and Wire Products.**


Here 2100 lb. LPR's reduced downtime frequency by about 86%; slashed scrap loss proportionately; stepped up production 12 to 15%.
Notice how compactly LPR's stock and, in contrast, the sprawling heap of 300 lb. bundles in right background.

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WHAT USERS REPORT

Here are excerpts from reports volunteered by Brite Wire fabricators who switched from conventional short-run bundles (150 to 400 lbs.) to LPR's:

Downtime due to coil changes reduced as much as 95% . . . Unloading time alone cut as much as 82% . . . Productivity increased from 20% to 33⅓% . . . Scrap slashed in direct ratio to coil changes avoided (up to 95%) . . . Man-hour costs trimmed 20% and more . . . Storage space reduced by 20% to 50% . . . Inventory management greatly improved . . . Returnable carrier problem and small coil racks eliminated.

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Detroit Steel Corporation—General Sales Office, Detroit 9, Michigan
Cable Address DETROSTEEL—New York

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A Unique and Unusual Use of Wire

by Robert F. Carmody
Industrial Engineer
Preformed Line Products Company
Palo Alto, California

This paper was presented at the West Coast Regional Meeting of The Wire Association on June 22, 1961, at San Francisco, California.

Mr. Carmody graduated from the University of California in 1958 and received a B.S. degree in Industrial Engineering. After spending some time on active duty with the U.S.A.F. Reserves, he joined Preformed Line Products in May, 1959, as an Industrial Engineer. Since that time he has also assumed Purchasing and Accounting responsibilitites and is currently setting up new in-plant systems and procedures.

This paper discusses some unusual uses of wire and wire products.

General

Preformed Line Products Company was formed in 1947 to manufacture and sell products made under patents taken out by our president, **Thomas F. Peterson.** Growth has been steady over the years and sales now amount to over $8,000,000 annually. Approximately 80% of the manufacturing is done at Cleveland, Ohio, and the remainder is done at Palo Alto, California, in a plant situated on the Stanford Industrial Park. Additionally, products are made and sold in India, West Germany, England, Australia and Canada by licensees in these countries.

* * *

Headquarters and Research and Engineering are in Cleveland. The power and telephone utilities use most of our production, but in the last few years we have been doing increased business with the government and with other industries — pre-stressed concrete, antennas and maritime, to name a few.

* * *

Figure 1 is a sample of one of our highest volume products, called a Guy-Grip Dead End; the product is used for attachment purposes on electrical utility pole guy wires.

* * *

Figure 2 shows the product being applied on a section of guy strand by one of our field demonstrators.

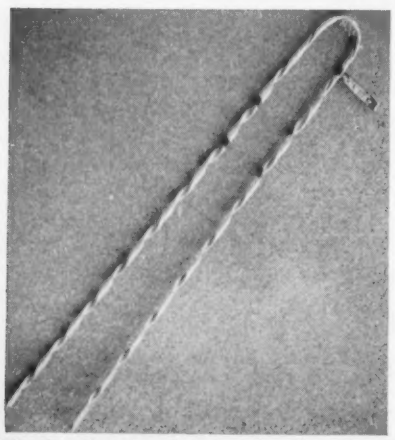


Fig. 1

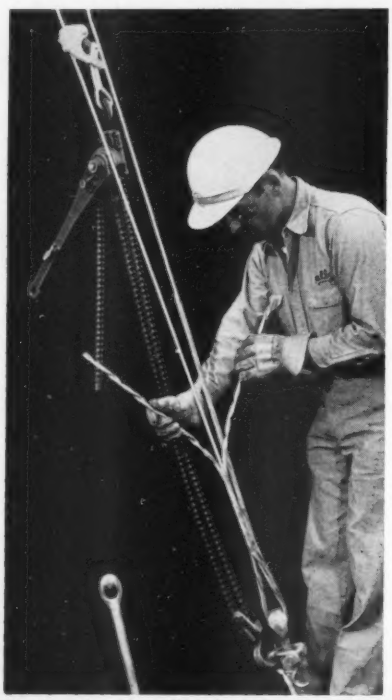


Fig. 2

Figure 3 shows one element of Preformed Armor, used to protect the point of suspension on overhead electrical conductors from abrasion and stress fatigue. This particular element is made of aluminum alloy wire which is bought in rod form, and then drawn to finished size in our wire drawing department in Cleveland. This aluminum wire and electrogalvanized steel wire represent our most heavy usage. However, we use approximately 200 wire sizes including many other types of wire such as Copperweld, Alumo-weld, bronze, stainless, cadmium copper, piano wire, and others. Each individual wire size can be used for many product sizes and configurations. All told Preformed makes over 3000 different products out of wire.

* * *

Figure 4 shows an installed set of Preformed Armor around a conductor at a point of suspension.

Manufacturing

The production department uses wire in coil form in catch-

Fig. 3

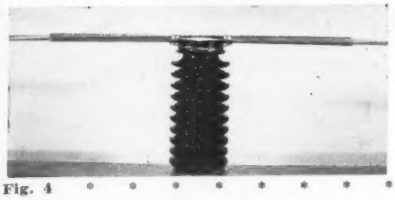


Fig. 4

weight coils of from 100 to 300 lbs. These coils are placed on a tripod-type pay-off reel with a free moving platform turning in the horizontal plane, and the wire is fed into a variable speed continuous wire forming machine. At the exit point of the forming machine, actual formation of the helix is accomplished.

* * *

A bracket holds a sleeve and quill die combination rigidly in place at the exit of the forming machine feed guides. The die was helically cut on a specially adapted milling machine to a size that will pass and guide the formed wire. I say this because over 90% of the actual forming is done between the three points shown in Figure 5.

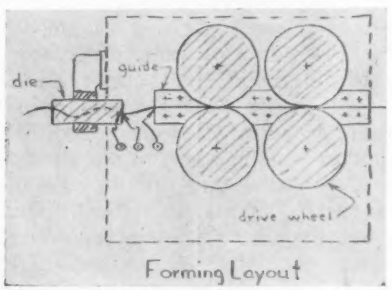


Fig. 5

1) **the exit of the last guide of the forming machine.**

2) **the entry of the forming die.**

3) **some point just inside the die, no more than ½" from the entrance.**

* * *

The die is set in the sleeve at an offset position relative to the incoming wire so that the wire will form in either right hand lay or left hand lay as required for our products. The die is then adjusted horizontally for inside diameter control of the helix and vertically for pitch length control. The pitch diameter and the pitch length specifications for each product resulted from many years of testing and design, determining the optimum gripping strength and ease of application of the product in the field. Depending, then, on whether the end product is going to be used for splicing, gripping, or protection, the pitch diameters and pitch lengths will vary, but in all cases the helix diameter is less than the conductor diameter. The tolerances obtainable in the forming operation are surprisingly close. The helix diameter can be held to a tolerance of $\pm 2\%$, and the pitch length can be made to a tolerance of $\pm 1\%$ at forming speeds of approximately 1500 inches per minute. The forming of the wire is both elastic and plastic in nature. In the process of forming the helix the wire actually twists approximately 3/4 of a turn per pitch. This is generally considered to be a good phenomenon, since the plastic deformation work-hardens the metal and also adds to stability in the forming of the helix. Years ago, spin forming of the product was tried, but the tolerances obtained were not close, and control of pitch and diameter were not satisfactory.

* * *

To dissipate heat produced in the forming of the product and to lubricate the metal, oil is picked up by the last, lower feed roll and applied to the material before forming. The forming machine continuously produces the product, and it is cut to length approximately 6 feet from the machine. Cutting is accomplished by a rotating device which consists of a knife blade actuated by a cam and contained in the periphery of a flywheel. This mechanism is propelled by a variable speed motor and gear combination, making it possible to obtain any desired length of product. The machine easily maintains a tolerance of $\pm \frac{1}{2}\%$.

* * *

The cut rods fall into a collecting tray, from which they are gathered, held flat on a table, and the burrs ground off the ends with a rotating sandpaper belt. The ends may also be wire-brushed for additional smoothness. Large diameter aluminum rods have hemispherical ends cut by a concave milling tool in a special operation.

* * *

The cut rods are moved to the finishing department for several additional operations. The rods are twisted together into subgroups, or "sub-sets", of from 2-15 rods each. The sub-sets are vapor degreased or hot caustic washed to remove the lubricating oil introduced in the forming operation. Next the center third of each sub-set is coated with a vinyl adhesive, clamped and baked thoroughly to fasten the individual rods together into one solid half-cylinder.

* * *

The inside surfaces of the outer thirds of the sets are covered with an adhesive spray and white aluminum oxide grit particles are allowed to fall and imbed themselves in this adhesive. The purpose of this grit is to increase the holding strength of the product, giving mechanical as well as frictional contact between the product and the strand or conductor. The center third of the set may be twisted or "cabled" to give it a strand-like appearance. Finally, the product is completed by bending the straight set in the center so that the two legs will easily wrap together by hand around the strand.

Quality Control

The company maintains a rigid set of controls and testing procedures to insure that its products are of the highest possible quality.

* * *

Since the gripping action of the products depends almost entirely on the relationship between the conductor or strand diameter and the helix diameter, it is important that tolerances be carefully maintained. The inside diameter of the helix is measured by placing a cut rod on a horizontal table equipped with a dial indicator, measuring the overall height or outside diameter of the product, and then subtracting two wire diameters.

* * *

The pitch length is important

(*Please turn to page* 1075)

Roll Threading of Fasteners

by Richard H. Bell, Superintendent
Bethlehem Steel Company
South San Francisco Bolt Plant
South San Francisco, California

A paper presented at the West Coast Regional Meeting of The Wire Association on June 22, 1961, at San Francisco, California.

Although the thread rolling process has been practiced for more than one hundred years in the manufacturing of fasteners, advances made recently have broadened its use and made possible many new applications. It was originally employed primarily by the fastener industry because of its low cost. The process is now recognized as a preferred method of producing threads and other forms of uniform quality, and is more widely used today than at any time in its history.

* * *

Before proceeding further with the discussion of the process and its merits, a brief description of the source of the wire or material used in the production of fasteners is in order. Fig. 1 shows

Fig. 1 — Open Hearth Furnace. * * *

a typical open hearth furnace, of which there are five at South San Francisco. The furnaces are 75 ton basic, cold metal charged, open hearths producing rimmed and killed steels. Fig. 2 is a

Fig. 2 — Tapping A Furnace. * * *

photograph of the tapping operation of one of these furnaces. The overflow at the top of the ladle is excessive slag which is caught in slag buckets on the pit floor. Fig. 3 shows a typical pouring opera-

Fig. 3 — Pouring Operation. * * * *

tion of a group of 24 ingots, each 13 x 13 in. and weighing 2500 lb. From these ingots, blooms and billets are processed by reheating and rolling on breakdown mills. The final steel mill operation, pictured in Fig. 4, is a bil-

Fig. 4 — Rolling Mill. * * * * *

let being rolled into rod which is normally coiled after passing through the final finishing or sizing roll stand. These coiled rods of various sizes are now ready for further processing into wire.

* * *

The next operations on these coils involve pickling, liming and/or phosphating, and drawing—operations with which, it is believed, all of you gentlemen are thoroughly familiar. When drawing rod into wire for a bolt shop the usual practice is to make a single draft of sufficient reduction to consistently produce uniform diameters with a minimum of cold work.

* * *

Now let us leave the drawn wire for a few minutes and look at a typical thread. Fig. 5 shows such

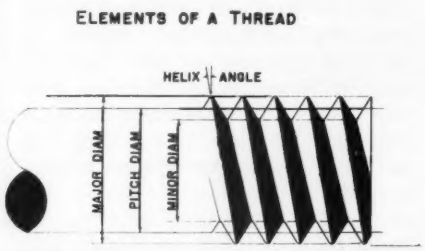


Fig. 5 * * * * * * * *

a thread and identifies the important elements of minor diameter, pitch diameter, and major diameter. Possibly you are more familiar with the term "root diameter" instead of "minor diameter", and "outside diameter" instead of "major diameter". This more popular nomenclature would apply only to external threads while the preferred terms have definite meaning to all threads—both external and internal.

* * *

When the hardened steel roll-threading dies are made, another element of the thread assumes its importance: the helix angle. If you will, picture "unwinding" a thread—similar to uncoiling a spring—and maintain the exact helix angle; this is the angle used to generate the form on flat dies. The profile, of course, is governed by the pitch or number of threads per inch. By definition, the pitch diameter of a perfect thread is the diameter of the coaxial cylinder, the surface of which would pass through the thread profiles at such points as to make the width of the groove

equal to the width of the thread. When rolling our American Standard or Unified, sixty-degree, threads this pitch diameter is the critical dimension. As you will notice, by Fig. 6, during the process of rolling a thread the drawn wire becomes the blank diameter. This is also the pitch diameter

DEVELOPMENT OF A ROLLED THREAD

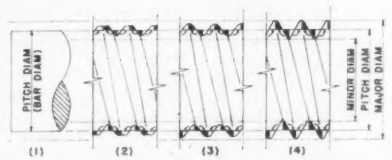


Fig. 6

when rolling a sixty-degree form.

* * *

Thread rolling is essentially a cold forming process where hardened steel dies are used to displace the metal or material below the pitch diameter upward to form the individual "peaks" of the thread form or profile. Actually, metal is displaced from each side of the crest or peak to complete the full form. By rolling suitable size blanks for a number of revolutions—say three to five—this operation is completed at amazing rates.

* * *

Various types of equipment are used to develop roll threads. Probably the most well-known is the reciprocating machine using flat dies similar to Fig. 7. These

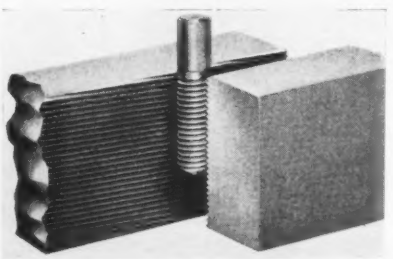


Fig. 7

machines are suitable for medium speeds up to 100 parts per minute; thread lengths up to 6 or 8 in. maximum, on a single pass; all generated on solid material like a bolt. Other types of equipment, like planetary rollers using one circular die and a stationary die segment, are faster on smaller diameters—say 1/4 in. and smaller—and are used for much shorter thread lengths. This planetary equipment will produce up to speeds of 500 parts per minute. Another style of roll threader uses two or three circular dies. The two die machines operate similarly to a centerless grinder employing a work rest below the centerline of the dies, with the dies rotating in a clockwise direction. On the three die machines the dies also rotate in the same direction and are located 120 degrees apart, having a toggle movement to allow the entry of the blanks prior to closing for the thread to be formed. This three die machine can thread hollow parts like spark plugs. Flat die or two die machines can only generate thread forms on solid material. In addition, there are tools available for use on lathes and screw machines which mount on the tool post for rolling threads on rotating parts. These tools operate like a knurling tool with the thread form transferred from the periphery of the two rolls on the tool to the desired part.

* * *

Now let us proceed to the advantages and applications of rolled threads.

Increased Strength

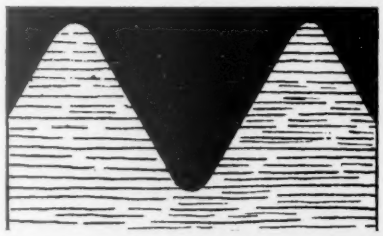
The cold work that threads receive during the rolling process strengthens them in tension, shear, and fatigue. When a thread is rolled the fibers of the material are not severed as they are when a thread is made by cutting or machining. They are reformed in continuous unbroken lines following the profile of the threads, as in any good forging, as shown in Fig. 8. Rolled threads resist stripping to a greater degree because shear failures must take place **across** rather than **with** the grain.

* * *

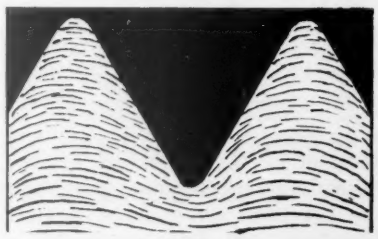
Thread rolling increases the part's resistance to fatigue failure in several ways.

* * *

By rolling between hardened smooth dies a burnished finish results on the roots and flanks of a thread. This surface is free from tears, chatter or cutter marks that can serve as focal



Cut Thread



Rolled Thread

Fig. 8

points of stress and, therefore, starting points for fatigue failures.

* * *

Rolling also leaves the surface layers of the threads, particularly those in the roots, stressed in compression. These compressive stresses will lower the applied tensile stresses which otherwise might cause fatigue failures.

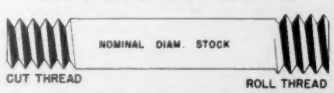
* * *

Rolled threads increase in hardness at the root up to 10 points Rockwell C on parts treated to 30 Rockwell C. This increase in root hardness adds considerably to the part's fatigue resistance.

* * *

Fig. 9 illustrates the minimum

ROLL THREAD STRENGTH ADVANTAGE



THREAD SIZE COARSE THD.	WEIGHT LBS./FT.	CUT THREAD STRESS AREA SQ. IN.	CUT THREAD BREAKING LOAD LBS.	ROLL THREAD STRESS AREA SQ. IN.	ROLL THREAD BREAKING LOAD LBS.	% INCREASE IN STRENGTH
3/8 – 16	0.376	0.0773	5025	0.0988	6422	27.8
1/2 – 13	0.668	0.1416	9204	0.1773	11524	25.2
5/8 – 11	1.043	0.2256	14664	0.2786	18109	23.5
3/4 – 10	1.502	0.3340	21710	0.4044	26286	21.1
1 – 8	2.670	0.6051	39332	0.7231	47001	19.5

FIG. 9

Fig. 9

overall percent increase in strength that can be expected from rolled threads over cut threads when the same diameter wire is used. These strength

comparisons are based on the stress area. This stress area is the theoretical area halfway between the minor diameter and the pitch diameter.

* * *

However, in Fig. 10, we see that for all practical purposes, these roll threads have a stress

ROLL THREAD TENSILE STRENGTH

STOCK SIZE (PD)	TYPE OF STEEL	TYPE OF THREAD	DATE OF TEST	ROLL THREADED ROD STRENGTH	STOCK STRENGTH
0.328	C 1020	3/8-16	1/8/60	6850 lbs	7050 lbs
0.439	C 1021	1/2-13	11/3/60	9250 "	9300 "
0.875	C 1060	15/16-9	6/23/60	73600 "	75600 "
0.941	C 1021	1-8	2/26/57	40350 "	40450 "
1.000	C 1045	1-7/64-8	11/9/60	76800 "	79000 "

Fig. 10 * * * * * * * *

area almost equal to their pitch diameter area. When performing these tests, a 36 in. long wire was threaded on one end. After threading, the bars were cut in half and identified. The breaking loads or tensile strength of the plain bars were compared to the threaded bars pulled against the rolled thread with a nut. These and continued tests all prove that a rolled thread will approach the full strength of a pitch diameter bar.

Material Savings

Roll threading will save material. No chips are produced in the thread rolling process. As previously mentioned, the blanks are made smaller than the finished thread, and material that is pressed out of the roots of the thread is rolled up to form the crests. Fig. 11 shows that actual

ROLL THREAD WEIGHT SAVINGS

THREAD SIZE COARSE THD	CUT THREAD STOCK DIA	CUT THREAD WEIGHT LBS/FT	ROLL THREAD STOCK DIA	ROLL THREAD WEIGHT LBS/FT	% SAVINGS IN WEIGHT	BREAKING LOAD (LBS) STRESS AREA	BREAKING LOAD
3/8-16	0.375	0.376	0.330	0.291	22.6	0.0773	5025
1/2-13	0.500	0.668	0.445	0.529	20.8	0.1416	9204
5/8-11	0.625	1.043	0.561	0.840	19.5	0.2256	14664
3/4-10	0.750	1.502	0.680	1.235	17.8	0.3340	21710
1-8	1.000	2.670	0.914	2.231	16.4	0.6051	39332

Fig. 11 * * * * * * * *

savings of material amount to 16 percent on large diameters and up to 25 percent on smaller sizes. This material saving is accomplished without any sacrifice in strength.

Accuracy and Uniformity

To produce accurate threads, close control must be exercised over pitch diameter, thread angle, lead, taper, roundness, and "drunkenness".

* * *

Major, pitch, and minor diameters are dependent on the blank diameter, the thread form of the dies, and the setup and rigidity of the equipment used.

* * *

Controlling the diameter of plain cylindrical blanks within close limits is relatively easy and economical either by using carbide dies, if the blanks are cold drawn or cold forged, or by turning, shaving, or centerless grinding if blanks are made from bar stock. Since no material is removed by the thread-rolling process and the thread itself blocks any possible elongation, too large or too small blanks will result in threads out of tolerance. Thread rolling dies of either the flat or cylindrical shape can now have their thread forms machined, ground, or lapped to the degree of accuracy required. The more modern thread rolling machines are rugged and easily adjusted. Thus, all the dimensions of the thread are readily controlled.

* * *

The tolerances specified for pitch diameter include all errors of pitch diameter, lead, and angle. Taper on pitch diameter depends upon the straightness of the blank and the setup of the machine, both of which are easily controlled by the average operator.

* * *

The accuracy of the lead produced is dependent on the accuracy and setup of the dies and the material being rolled. In most cases, the lead of the thread on the die is exactly reproduced on the material rolled. Likewise, drunkenness is dependent on die design, careful die setup, and proper feeding.

High Degree of Surface Finish

In any cold forming or high pressure operations, the surface finish left on the work is a close approximation of the surface finish of the dies. This also holds true in the case of thread rolling except that the threads produced are ordinarily smoother than the dies or rolls. This improvement is due to a slight slipping or burnishing action on the part by the dies. Smoothly finished blanks—typical of well drawn wire—threaded with carefully ground or polished dies will produce surface finishes of 5 micro-inches or better. Ordinary cut threads have a surface finish of well above 50 micro-inches—and sometimes as high as 200.

Speed and Economy

Thread rolling is unique in its ability to maintain the accuracy of the original setup during extremely long runs of high speed production. It has long been conceded to be the fastest method of producing screw threads. The rolling machines may be manually loaded or equipped with semi-automatic or completely automatic feeding devices. Fully automatic machines are operated in batteries with several machines to each operator, threading hundreds of thousands of pieces each shift.

* * *

Thread rolling dies never require sharpening and fail either by fatigue crumbling of the crests, or by spalling away of entire threads. Either type of failure is easily detected because it is noticeable on the threaded part. The inherent uniformity of rolled threads greatly reduces inspection labor.

Versatility of Application

Thread rolling, or roll forming, is an extremely versatile process capable of producing many forms on a wide variety of materials. Its possibilities are limited only by one's imagination and willingness to experiment.

* * *

All of the commonly used thread forms can be produced by rolling, including Unified and American Standard, Whitworth, British Association, Metric, Acme, and worm threads in both right and left hand forms. Also included

(*Please turn to page* 1069)

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Coatings on Stainless Steel and High Nickel Alloy Wires

by Kenneth P. Brown
Techalloy Company, Inc.
Long Beach, California

A paper presented at the West Coast Regional Meeting of The Wire Association at San Francisco, California, on June 22, 1961.

Not long ago I was called to a plant newly engaged in cold heading stainless steel wire. Quantities of bare stainless steel wire sat waiting to be cold headed, but operations were at a standstill. There had been nothing but trouble with galling. Galling of stainless steel and high nickel alloy wire is very common, not only in the cold heading process, but also in drawing, coiling and forming. To overcome this sticking or seizing, a lubricant is used either on the wire or else on the die or forming tool. Generally, in the cases of wire drawing, cold heading and spring forming, the lubricant is applied directly to the wire.

* * *

In wire drawing, where severe reductions in cross sectional area are being made and work hardening tendencies are rapid, it is necessary to have lubricants or coatings on the wire which will withstand great pressure as the wire is being pulled through the die. In the case of wire fabrication such as weaving, cold heading, spring coiling, etc., the operation is generally less severe and coatings or lubricants on the wire do not usually require resistance to extreme pressures. There are exceptions to this where you have severe cold upsetting or heading.

* * *

Types of coatings in use are as numerous as there are companies making them. All have merit in the applications for which they were designed. In general, coatings for stainless steel and high nickel wire can be classified as follows: metallic, oxides, dry coatings, and wet coatings.

* * *

In the wire drawing process, the metallic coatings are generally used on the stainless steels and the chrome-iron-nickel grades of high nickel alloys. These metallic coatings are also used in spring forming and cold heading. In the cold drawing process lead is commonly used on alloys of 18-8 or the 300 series of stainless steels, on Inconel and Inconel "X", whereas copper would be furnished on these same alloys for cold heading applications. In the case of spring manufacture, the lead coating would be most commonly used, with copper supplied on Inconel "X" and possibly "K" Monel. Other types of metallic coatings are zinc and cadmium.

* * *

The oxide coatings are rarely used in the manufacture or cold drawing of wire in these alloys. However, these oxides have good lubricating qualities, particularly in the spring coiling business. The failure to use the oxides in a more extensive manner is due more to the difficulty in application and removal than to their lack of merit as lubricants.

* * *

The so-called "dry" lubricants, such as soap, lime, stearate, cowles, and forms of molybdenum disulfide, are used on the softer wires such as nickel, Monel, etc. These wires can be drawn, cold headed and spring coiled with the dry lubricants. Weaving and other means of forming can also be performed on the softer alloys using this type of lubricant.

* * *

The "wet" coatings are usually petroleum based, and are the most versatile and widely used coatings in the wire drawing and forming business. More often than not, one of these wet coatings will be used along with a metallic, an oxide, or a dry coating. Also included in this area of wet coatings is another form of molybdenum disulfide which has particular value where high pressures and temperatures are involved. The wet lubricants are not often used by themselves in the cold reduction or drawing of wire. They are sometimes used as the sole lubricant in the cold heading and spring coiling of some of the softer alloys such as nickel and Monel. It may be pointed out that a great deal of success has been had in using chlorinated paraffin types of coatings.

* * *

How often we have heard customers complain about "lousy coatings on wire." The customer will say, "The copper's peeling," "The lead's too thick," "The coating's not uniform," "The oxide won't come off," "The soap and lime has evaporated," "The wet lubricant just **doesn't** do the job." These are complaints heard every day in the wire manufacturing and processing business, and they help to point up the very important factor of **correct** application of the correct alloy. The methods of applying these coatings more often than not determine the success or failure in the drawing or fabrication of these stainless steel or high nickel alloy wires.

* * *

In applying lead to the surface of stainless steel, Inconel, or Inconel "X" wire, it is necessary to have a completely clean, dry surface. The cleaning of the wire

prior to lead coating should be done in a sulfuric or hydrochloric bath to create an active surface on the wire. Next, it is important to have a high purity lead that is perfectly free from bismuth, antimony, and other minor residuals which are harmful. Also flux, which serves to further clean the wire and to prevent the wire from further oxidizing, should be placed on top of the lead bath at a thickness of 1/4 to 1/2 inch. It is important to have the lead bath at the proper temperature, because if it is too hot it will become too thin and run off the wire, and if too cold it will be thick and leave too heavy a deposit. Upon removing the wire from the lead bath the coil should be throughly shaken to knock off excess lead and prevent the strands of wire from sticking together. This is the more common method of applying lead, but continuous strand lead coating can be done following the same practice, except the baths are arranged in a continuous straight line.

* * *

Copper is applied to the stainless steels, the Inconels,* and Inconel "X"* where it is applied by means of the batch plating process. This is a simple process and involves the use of various solutions with copper anodes and induced current to carry out the plating process. Among other plating methods is the continuous copper plating process which is being used in some of the wire mills today. This continuous copper plating process depends on an extremely clean, pickled or etched wire surface in order to insure even copper coating. The simpler batch process, however, when properly controlled, produces completely adequate and even copper plate. The most important factors in copper plating are clean wire and clean plating solutions.

* * *

The oxide coatings which are being used on stainless steels are found predominantly in special applications. These coatings are applied through a baking process after certain substances have been added to their surface. This baking causes these additions to oxidize and leave a film on the surface of the metal; actually, part of the metallic surface is also oxidized.

* * *

Dry lubricants, or coatings, are applied in usually one of two manners. Either the lubricant is drawn on, or the wire is dipped in the coating and it is allowed to dry or bake on. Soap is often mixed with lime and put in the die box and the wire is drawn through the mixture. The pressure from drawing causes the soap and lime to adhere to the surface of the wire, and it forms a very slippery, even coating. The stearate and plain lime coatings are usually put on the wire through a dip process. The wire is then allowed to dry and there appears a white, powdery substance which, when the wire is drawn through a die or formed or headed, acts as a lubricant. There are other forms of dry lubricants which are used, but for the most part the ones mentioned above are the most common ones.

* * *

Wet lubricants are more universally used than any of the others. This group includes the paraffin based and chlorinated based compounds, as well as the sulfur based, asphalt based, and the molybdenum disulfide lubricants. Usually these lubricants are applied either by dipping the wire into the lubricant and then drawing, heading, or forming, or by pressure fed lines which allow the coating to flow onto the material during the working or forming process.

* * *

Again it should be pointed out that these wet lubricants are generally used in connection with one of the other types of coatings such as lead or copper. For example, in the cold heading of Inconel* or stainless steel, a light chlorinated paraffin does an excellent job when used with a copper coated wire.

* * *

All of the above coatings have specific applications, but they will be covered only generally in this paper. A spring manufacturer is probably more conscious of the effects of coatings than any other wire user. In his business it is virtually impossible to manufacture springs without some sort of coating, unless, of course, it is straight lathe coiling. To prevent seizing and galling in the guides and rollers of automatic spring coilers, it is necessary to have some form of coating. The most widely used and accepted coating is lead. Copper is also widely used, and the oxide coatings are probably next in importance. These coatings are used on spring wire of the stainless steel, Inconel* and Inconel "X"* variety. Inconel "X",* however, should be used only with copper coating and not with lead or oxide. In the very small diameters, such as .015 and smaller, spring wire is sometimes furnished without any coating at all. In this type of situation, a wet lubricant may well be of some use. The softer wires such as nickel and Monel* have been coiled successfully with soap and lime coatings. If the soap and lime is not excessive the operator will not experience excessive build-up on the coiler. In coiling Type 302, if the wire has been properly coated very little problem is ever experienced, even in the most severe forming operations. On the other hand, even with its copper coat, Inconel "X"* tends to be difficult to form due to the alloy's stiffness. It has been found that chlorinated paraffin works well in tough forming or coiling jobs when used with the copper coated Inconel "X".*

* * *

Cold upsetting of stainless steel, Inconel* and Inconel "X"* generally is done with a copper coating. This wire is very often drawn through a soap and lime mixture to add extra lubricating qualities to the surface. The copper coating of these alloys must be extremely uniform and even throughout. A bright copper coat should not necessarily be construed to mean it is any better than the black or oxidized copper

that is sometimes seen on heading wire. In many cases, the blacker or more oxidized copper coat has more lubricating qualities than the bright copper coat. Monel* and nickel are generally furnished with a soap and lime or stearate coating which is adequate on these softer materials. Due to their slower work hardening rate, there is not as much friction created in the heading dies.

* * *

The wire weaving industry is somewhat different in that it very seldom requires the conventional type of coating or lubricant. About the only coatings used are waxes which are primarily used in the manufacture of wire belts. Straight weaving can be done using bare wire. This also facilitates spot welding, as a clean surface is required for this operation.

* * *

Another area of work is that of hot heading or hot upsetting. Here the wire or rod is heated to an extremely high temperature in the neighborhood of 1800-2000° F. This is done where difficult head configurations are being formed, particularly on alloys of stainless steel, "K" Monel,* Inconel,* and Inconel "X".* The blank, or wire, is either heated by induction or resistance and is then fed into the die for forming. In order to prevent the material from seizing or galling it is necessary to have a lubricant that can be applied either to the material or die as the material is entering the die. Here molybdenum disulfide is often used as it has good resistance to the high temperature and it retains its lubricating qualities. However, caution should be exercised in using this lubricant on the high nickel alloys, especially "K" Monel,* Inconel,* and Inconel "X",* as it is possible that the sulfides could cause a diseasing of the nickel which would result in cracking. Most of the paraffin based and chlorinated based lubricants do not have sufficient lubricating qualities at these high temperatures, and other lubricants must be used for coatings. Many times, with proper die design, the hot heading process is carried out without any kind of coating or lubricant.

* * *

In removing the coatings and lubricants which have been discussed, there are numerous solutions and methods. The ones which will be mentioned here are among the older, most dependable ones. We are aware that there are certain methods employed to achieve effects other than straight removal of coatings, but they will not be considered at this time.

* * *

The 15-20% nitric acid bath at 140-160° F. is the most common method for removing lead, copper, soap and lime, and stearate from these alloys. There are certain variations in this solution for the different alloys. For example, to remove copper from Monel* the wire should be held in the nitric acid for 30 seconds, then removed and checked to see if the copper has been completely removed. This 30 second dip should be repeated until all coating is gone from the surface of the wire, then the wire thoroughly rinsed. This process also applies to nickel. The reason for this rapid acid attack on these two alloys is due to the absence of chromium, which is the element accounting for most of the acid resistance in the stainless steels and high nickel alloys. This same method may be used for the removal of stearate and soap and lime from these alloys.

* * *

In removing oxides from stainless steel wire there is a three step process which seems to do the best job. First is a sodium hydride dip, followed by a 10% sulfuric bath for 15 minutes and completed with a 20% nitric, 5% hydrofluoric pickle which should not be allowed to be in contact with the metal more than one minute at a time. In this manner the wire is dipped intermittently in this last solution until all the oxide is removed, then it is thoroughly rinsed. Here again there are other faster, stronger acids which have a more rapid attack, but they should be used with caution.

* * *

The removal of chlorinated paraffin is a comparatively simple vapor degrease using trichloroethylene. The removal of the molybdenum disulfides from wire usually requires a solution as follows: 2½% nitric, 2½% sulfuric, 15% hydrochloric. The wire is dipped in this solution at intervals of not more than one minute. The wire is then removed from the solution and checked for any remaining coating. The dipping is continued until all the molybdenum disulfide is removed, then the wire is rinsed. It should be noted that of the class of alloys being discussed, 18-8 stainless steel is the only one using this particular coating.

* * *

It is recommended that any coating be removed from wire prior to heating at elevated temperatures. Failure to do so could result in cracking or diseasing the wire. Such coatings as lead or the sulfur based oils should always be removed before heating, even on the stainless steels, although there is much discussion as to the harmful effects caused by stress relieving the wire with the coat left on. There have been cases where stainless steel springs which were drawn from lead coated wire with the coating left on during stress relieving, have displayed a crazed surface. This lead coat should always be removed from any of the high nickel alloys prior to heat treating, thermal treatment, or high temperature service. A cracked, diseased surface would also be likely to occur in the case of sulfur based coatings or lubricants not being removed before heating.

* * *

In the case of copper the problem of removal is not as acute as it is with lead or sulfur. For instance, no problem would be apt to result from heating Inconel* or stainless steel with the copper left on. However, if Inconel* is annealed at a temperature above about 1500° F., or if Inconel "X"* is heat treated with the copper left on, it is possible that there could result a copper dilution of the alloy at the surface which might result in loss of me-

(*Please turn to page* 1078)

THE ELECTRIC WIRE & CABLE SECTION
of
THE WIRE ASSOCIATION

The committee, appointed by the Association's Board of Directors, the Electric Wire and Cable Management Committee, extends to all persons interested in and concerned with the production of insulated wire and cable a cordial invitation to join with them in promoting the progress of this branch of the wire industry. This Management Committee, as of April 26, 1961, is comprised of:

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The committee arranges for papers for regional meetings and the Annual Convention, reviews them to see that they are desirable as to subject matter and quality, and formulates policies that will promote the best interests of insulated wire production personnel. Recent authorization to increase the membership to twenty-five will be implemented by further appointments in the near future.

You are invited to send for a booklet describing the activities of The Wire Association and a membership application card.

THE WIRE ASSOCIATION

RICHARD E. BROWN, EXECUTIVE SECRETARY

453 Main St. **Stamford, Conn.**

Two New Modern Wire Plants Dedicated

On June 7, 1961, **Continental Copper and Steel Industries, Inc.,** dedicated two new plants that recently went into operation at Linden, New Jersey.

* * *

These mills are additions to the present facilities of Continental's **Hatfield Wire and Cable Division,** in nearby Union and Hillside. These facilities now include:

1—The new completely automated 45,000 square foot copper rod mill at Linden, where the 54-inch-long copper wire bar is hot-rolled into rod;

2—A modern 80,000 square foot wire drawing and stranding plant at Union, which fabricates both copper and aluminum wire, from .005" to .250 inches in diameter, in 7 wire to 127 wire concentric-lay strands. It also produces concentric rope-lay strands from 49 wire (7X7) to flexible stranded conductors containing over 5,000 individual wires. The copper wire is drawn from rod produced by the Linden mill; the aluminum wire from aluminum rod supplied by another Continental—the *Hanover Wire Cloth Division.* The Union plant supplies wire to the Hatfield Division's two insulating facilities;

3—The new 240,000 square foot rubber insulating mill at Linden;

4—A 200,000 square foot plastic insulating plant at Hillside, which originally housed all the Hatfield Division's manufacturing operations, but which is now devoted entirely to production of plastic coated wire and cable.

* * *

Eventually, it is planned that all Hatfield manufacturing operations will be located at Linden, providing a unique integrated wire and cable complex all on the same site.

* * *

Founded 50 years ago as a manufacturer of molded rubber products (and originally known as the Hatfield Rubber Works), Hatfield Wire and Cable has specialized in production of insulated wire and cable since 1922. It has been a Division of Continental Copper & Steel Industries, Inc. since 1948. Its present vast four-plant facilities grew from an original small plant at Hackettstown, N. J., and subsequently, in 1928, a 20,000 square foot building at Hillside.

The mechanical details of the rod mill were described in an article in Wire and Wire Products in December 1960, by M. M. Feuer, captioned "New Developments in Copper Wire Rod Mills".

The 'Robot' Copper Rod Mill

A completely "robot" operation, Continental's new $3,000,000 Linden copper rod rolling mill, is the most advanced plant of its kind in the U.S. copper industry, and probably in the world.

* * *

Only one other fully automated copper rod mill, built three years ago, exists in the United States (operated by the **Packard Electric Division** of General Motors, at Warren, Ohio) according to the Industrial Equipment Division of **Baldwin - Lima - Hamilton Corporation,** which designed and built both facilities.

* * *

From the moment 265-pound bars of electrolytic copper are automatically conveyor-fed into its furnace (at the rate of one every 27 seconds) until the 5/16" diameter copper rod comes rolling out of the last "stand" (at a speed of 2,800 feet a minute, to be automatically coiled and tied, no human handling is involved.

* * *

The only human "help" the rod rolling operation requires is:

A single engineer to pre-set the mill's automatic controls, and watch the operation from his control "pulpit"; and
Two men to operate the giant overhead crane (which loads copper bars on the furnace conveyor) and the fork lift trucks (which remove the finished rod coils).

* * *

Including maintenance men, the plant has only eight employees. Most other copper rod mills currently in operation in the U.S. require operating crews of 20 to 30 men, depending on the degree of mechanization.

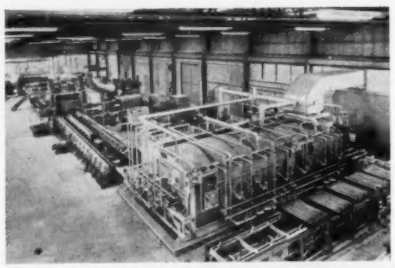

Fig. 2 — The new automated B-L-H Copper Rod Mill with the billet heating furnace in the foreground. At the far end, not visible, are the pickling and rod storage facilities. * * *

In full operation, the new mill can turn out enough copper rod (217 miles) in one eight-hour shift to stretch from New York to Washington, D. C., enough in a 50-week year to circle the earth more than twice. Operating on an eight-hour shift, five-day week it can process more than 65,000,000 pounds of copper a year; capacity can be doubled by extra shifts.

* * *

A 45,000 square foot, L-shaped, single-level building, the rod mill is so designed that the control engineer can watch every stage of the operation from his "pulpit," or control tower, where electrical controls for the entire plant are contained in a single giant console. "Trouble" signals are instantaneously flashed by the machine involved to the control tower for the necessary adjustments; built-in

Fig. 1 — Overall view of the Rubber Insulating Plant at Linden, N. J. The rod mill is behind this building. * * * * * * * * * * * * * * * *

"safety" devices would simultaneously stop the mill's operation.

* * *

From the storage area (or direct from incoming trucks) the 265-pound, 52-inch-long bars of pure electrolytic copper are lifted by a 10-ton overhead travelling crane and deposited on a conveyor belt that feeds them into a 29-foot-long gas-fired furnace, at a precise and automatically timed rate (one every 27 seconds).

* * *

Inside the furnace, the bars travel on "walking beams" which move them gently from position to position, instead of pushing them, which might deform the bar's shape.

* * *

The bars come out of the furnace heated to a cherry red, and are conveyed to a three-roll roughing mill, through which the red hot metal makes five "passes"—being automatically "manipulated" and reversed for each pass—and the shape of the metal changed from a 4″ by 4″ bar to oval.

* * *

After the fifth pass through the roughing mill, the metal is moved along conveyor tables, through three intermediate straight-line mills and six finishing mills—where it is reduced to 5/16″ diameter rod—at a constant automatically-regulated speed.

* * *

Rolling off the last "stand" at a speed of approximately 2,800 feet a minute, the rod is automatically coiled on Garrett type coilers, discharged from the bottom of the coiling machine to a conveyor, and moved to an automatic tying machine at which the coil of rod is tied with wire in two places. (The coilers adjust themselves to any change in the speed of the rod.)

* * *

The coiled rod is then uprighted and placed on one arm of a turnstile; when one arm is full, the turnstile rotates itself to present an empty arm for the next coils.

* * *

A fork lift truck removes each group of coiled rod from the turnstile and transports the rod either to storage or to a pickling tank where it is soaked in dilute sulphuric acid to remove scale.

* * *

From the acid tanks, the coiled rod moves through rinses and neutralizers to remove the acid. From the last rinse, the coils are removed by fork lift truck and transported to the Hatfield Wire and Cable Division's wire-drawing plant.

* * *

The rated capacity of the new "robot" mill is 16.7 tons of copper per hour, but its controls can be adjusted to process as much as 20 tons an hour. At the 16.7 tons rate, it can produce approximately 144,000 feet of rod an hour, or 1,152,000 feet (217 miles) of rod in an eight hour day. Each stage of production has its own controls, all synchronized with and through the master control console, since the metal must roll through the mill at a constant speed to avoid either tension or slack in the rod. As an example, if the front and rear ends of separate rods running through the mill come too close for comfort, an automatic switch divides them onto "two tracks," alternating them between two sets of grooves. In all, from the furnace to the coiling machines the rod travels a distance of 377 feet . . . Eighteen separate motors, ranging in size from three horsepower (for the turnstile) to 400 horsepower (for the giant roughing mill) are used in the mill . . . Power is supplied by a special primary electrical substation adjacent to the mill, which provides 4160-volts, three-phase, 60-cycle alternating current.

* * *

The plant has its own completely automatic cooling system for the machines which circulates and recirculates water from a 150,000 gallon "swimming pool" tank located just outside the main building.

The Rubber Insulating Mill

Capable of producing (from raw rubber and bare wire) virtually any type or size of rubber-insulated wire and cable used in American homes, industry or communications, Continental's new $7,000,000, 240,000 square foot rubber mill and wire insulating plant at Linden is one of the largest—and is believed to be the most highly mechanized

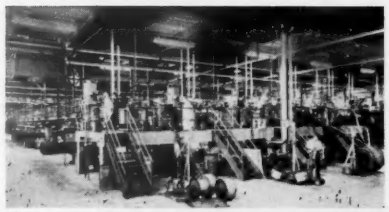

Fig. 3 — View of the eight Royle automatically controlled continuous extruding and vulcanizing lines, each 250 feet long. Vulcanization is done under 250 pounds of steam pressure.

—of its kind in the United States.

* * *

Its finished products range from small, single-conductor building and communications wire to giant 15,000 volt utility power cables and huge lead-sheathed cables for underground transmission.

* * *

The plant is equipped with the newest machinery, much of it developed by the Hatfield Wire and Cable Division itself, to:

1) Automatically blend and manufacture its own rubber compound (Butyl, GRS, Neoprene or any other polymer);

2) Automatically coat the bare multi-conductor wire, vulcanize the rubber and cool and reel the cable, in one continous operation, on eight giant 250-foot long machines;

3) Tape, braid, finish, and lead-cure the wire and cable, as required by its particular end-use.

* * *

Most operations are completely automatic, requiring only checking of the machines and the controls. The plant currently is operated by approximately 250 employees, on a three-shift, around-the-clock basis.

* * *

At capacity, the rubber mill can manufacture more than 1,000,000 pounds of rubber compound in a five-day week. While the amount of wire and cable produced in any given period depends on the market, and the type being manufactured, the wire insulating plant could turn out, at top capacity, up to 5,000,000 feet (nearly 1,000 miles) of finished wire and cable in a single day.

* * *

In the rubber plant, situated on the floor above the insulating mill, the various compounds are developed in a special laboratory section. The basic ingredients are combined with agents and mixed in two giant automatic Bambury mixers, (each

(*Please turn to page* 1065)

Elgin Diamond Compound is formulated for the job . . . no instinct or "feel" required

Pre-mixed diamond compound—from any point of view—is superior to dry diamond individually mixed in the die room. In Elgin diamond compound each particle of diamond is thoroughly wetted and permanently suspended in the vehicle. Diamond won't settle or concentrate.

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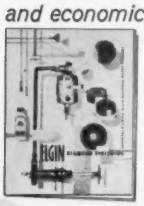

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Wire Kinks

Readers are invited to send us how-to-do-it items for this department. For each item received that is published we will pay contributors $10.00. Your cooperation will be appreciated by us and our many readers. May we hear from you?

Effect of Drawing on Tensile Strength

QUESTION

If you have any charts showing the increase in tensile strength resulting from different percentages of reduction in drawing patented rods, I would appreciate receiving a copy.

ANSWER

The answer to the effect of percent draft on the increase in tensile strength is shown in the accompanying graph.

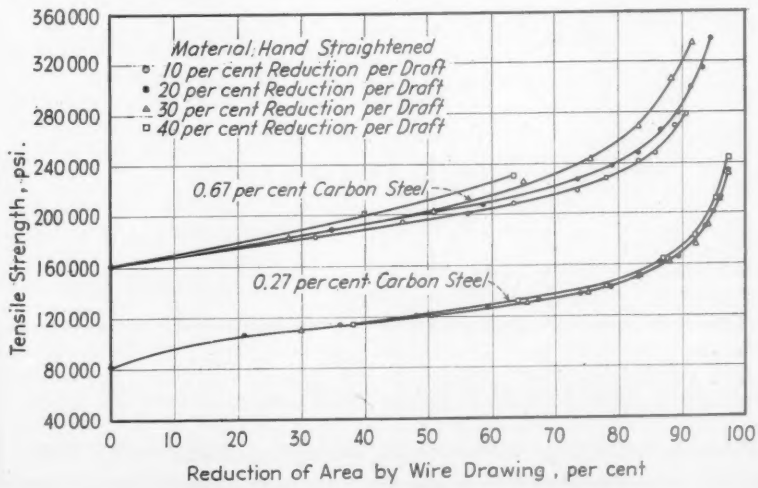
* * *

The materials represented in the graph are as follows:

.67% carbon
—.218" diam. patented wire
.27% carbon
—.220" diam. patented rod

* * *

This graph was published in a paper entitled "The Physical Properties of Steel Wire as Affected by Variations in the Drawing Operation", which was published by A.S.T.M. in Vol. 42, in 1942. Reference to the article will provide additional information.



Cold Heading Defects

QUESTION

We run into trouble occasionally in our cold heading work and wonder if you can point out some of the factors that may be responsible for defective products.

ANSWER

Defects in cold headed products may be the result of either of two causes: 1) Inferior or faulty machine operation in the manufacturing plant, or 2) Inferior or defective materials—the rods and wire. Sometimes it is a combination of both.

* * *

Where the product fault is something like a cracked or torn head, it may be alleviated, if not entirely corrected by annealing or stress relieving the material prior to cold heading. Excessive segregation, unsuitable grain structure, a porous heat of steel, non-metallic inclusions, seamy or lapped material, non-uniform softness or too great a degree of hardness, all may contribute to poor results.

* * *

A fold may result from a poor first blow on a double stroke header. Misalignment of the face of the heading die and poor selling of the knock-out adjustment of the trimmer can cause imperfect bolts to emerge from the machine. Accurate adjustments are a primary requisite to good results.

* * *

Whenever trouble rears its ugly head, the first thing to do is to determine its cause. Should it be material, the source of supply must be advised and specifications issued that will cover what is expected.

* * *

Where the trouble is in the plant, obviously steps should be taken to correct it, whether it be in a machine or an operator of a machine.

* * *

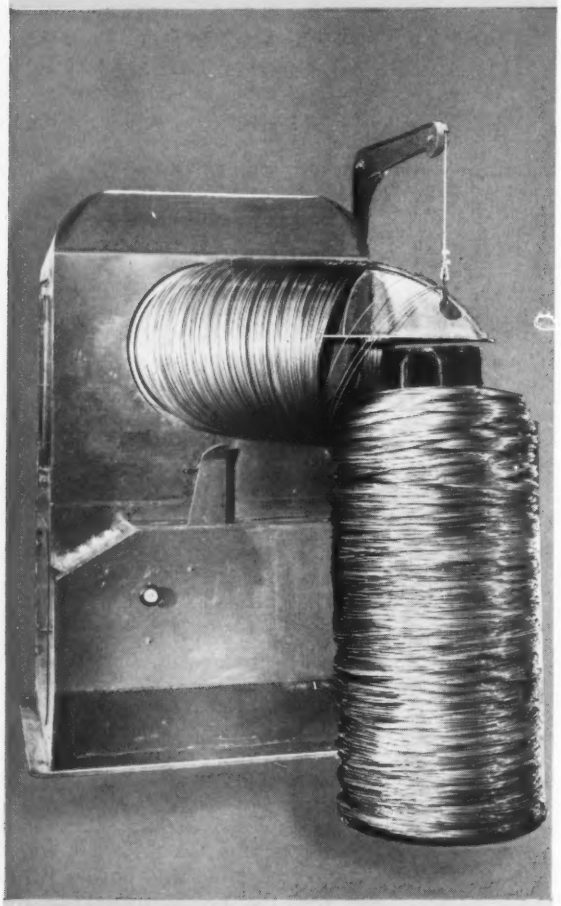
Occasionally, a type of fastener will necessitate a new design to facilitate forming, but the selection of a steel of the right analysis for a job, the matter of annealing and the inspection of material for quality and properties, all should be routine procedures.

New Use for Wire Cloth

The Reynolds Division of National-Standard Company in Dixon, Ill., is weaving large quantities of

The DBH-8

WHITACRE DEAD BLOCK



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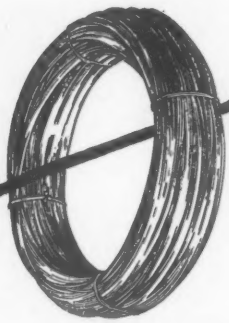
Wire Kinks



E.C. grade copper wire for use as static shields at two radar sites, in Alaska and Greenland.

* * *

The cloth is made of .018" pure copper wire with a 16 mesh. It is used on all floors of the buildings and in the flat portions of the roofs as a shielding against static that could interfere with radar signals, thus preventing the stations from receiving clear warnings of missile attacks.

* * *

Well over two million square feet of the cloth are being installed. This would make a four foot wide belt of mesh 107 miles long, or supply enough screening to make nearly 57,000 screen doors. Most of the cloth is placed between two layers of 2-inch foam glass insulation. The ends of the wire are tinned to facilitate soldering to the galvanized metal siding of the buildings to ground the shielding.

Extruding Phosphor Bronze

QUESTION

We would appreciate the fullest possible information you have available on the extrusion of phosphor bronzes, and the following type in particular:

Tin	4.5 to 7.0%
Phosphorous	0.02 to 0.40%
Lead	0.02 Max.
Copper	Balance

Total impurities including Pb. not to exceed 0.20%.

We have a 600 ton horizontal extrusion press with a maximum ram speed of 0.46 ins./sec. Our standard billet is four inches diameter and thirteen inches long. Up to present we have had little success using our normal procedure for copper and brass.

ANSWER

Reference is made to your letter requesting information on extrusion of phosphor bronzes on a 600 ton horizontal extrusion press. Our comments are as follows:
Phosphor bronzes with more than 4% tin are very difficult to extrude because of narrow hot working range. A slow press like the 600 ton press you are referring to and which has a maximum ram speed of .45" per second is therefore not suitable for this application because the billet cools off. Even on a fast press of the same capacity one should use small size billets in order to have high unit pressures on the billet area available, and to keep the temperature on the low side.

Shaving Copper Rod

QUESTION

Why are copper rods "shaved" and how is this accomplished?

ANSWER

Copper rod is shaved, that is, has the outer surface removed, to provide a surface that is free from slivers, fins, seams, burrs, checks and dust that may be present on hot rolled rod after pickling.

* * *

The trend toward smaller electrical apparatus has called for ever finer wires. By removing poor surface conditions the wire is less likely to break in drawing and subsequent manufacturing operations and better surfaces are secured for uniform, flawless enameling. This latter is important, when it is considered that a Formvar coating, for example, may be only .002 inches thick.

* * *

Rod to be shaved usually is given one or two passes through standard drawing dies to make the rod round and to minimize the amount of copper that will be removed by the shaving die.

* * *

From the dies that round off the rod, the wire is passed through a special guide die to align the rod accurately for its passage through the shaving die, which is a tungsten carbide with blades so arranged that the rod surface is chipped or shaved off. This must be done cleanly so that there are no visible marks or scratches on the surface.

* * *

Starting with a ½ inch rod, the dies could be arranged as follows: First pass to .405"; second pass to .398"; guide die to .388"; shaving die to .378", etc. through other drawing passes.

* * *

Shaving may be done as a separate operation or continously in the drawing machine. While shaving is almost an essential for very fine wires, it has advantages for many larger conductor wires that must be enameled and where accuracy of dimensions is important.

* * *

There is some question as to the economy of shaving small diameter rod, due to the larger percentage of copper thus converted into scrap. The chips removed, of course, are collected and reused as scrap.

Pneumatic Conveyor Paves Way for Production Speed-Up

Market demands of the growing wire processing industry made it necessary for this company to accelerate and expand wire insulating operations. Before an efficient program could be carried out, however, manual handling methods had to be replaced. They were, with a pneumatic system, designed as a process tool as well as a conveyor. As a result, the company doubled dry blend output without increasing labor costs. This cleared the way for easy and inexpensive future expansion of production facilities.

When time-consuming manual methods for handling PVC (polyvinyl chloride plastic compound) stymied efforts to upgrade productivity of its six wire insulating extruders, **Circle Wire and Cable Corporation,** Long Island, New York, turned to pneumatic conveying as a solution.

* * *

A Dracco Airstream Conveyor System was installed and its efficiency not only made possible the acceleration of extruder activity, but also has paved the way for expansion of production facilities. The system, which functions as a process tool as well as a conveying method, completely eliminated five manual handling steps, enabled output to be greatly increased without any increase in labor costs and has been responsible for an improvement in the over-all quality of insulation materials.

Keeps Operators at Their Posts

One of the most significant benefits of the system is that it frees extruder operators from the task of manually replenishing supplies of PVC in their machines. Before the system was installed, extruder operators had to leave their work stations about every 45 minutes to get additional PVC. This involved bringing drums back from storage by lift truck and then hoisting them overhead with block and tackle in order to refill the machines.

* * *

Operators who were away from their machines could not give full attention to monitoring temperatures and other important operating details and thus were handicapped in averting possible malfunctioning. At such high speeds, breakdown of extruders, wire feed or quality of the PVC can be costly.

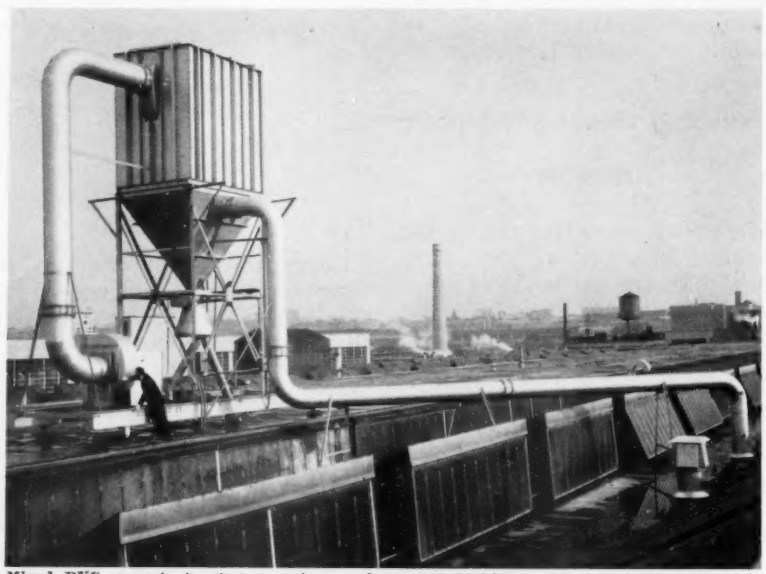
* * *

Now, machines are kept fully supplied by the Dracco System which delivers material from storage via moving air at the rate of 6,000 lbs. per minute. There are no drums to manhandle, no hoisting with block and tackle. A marked improvement in quality control has resulted because operators can concentrate fully on the performance of their equipment.

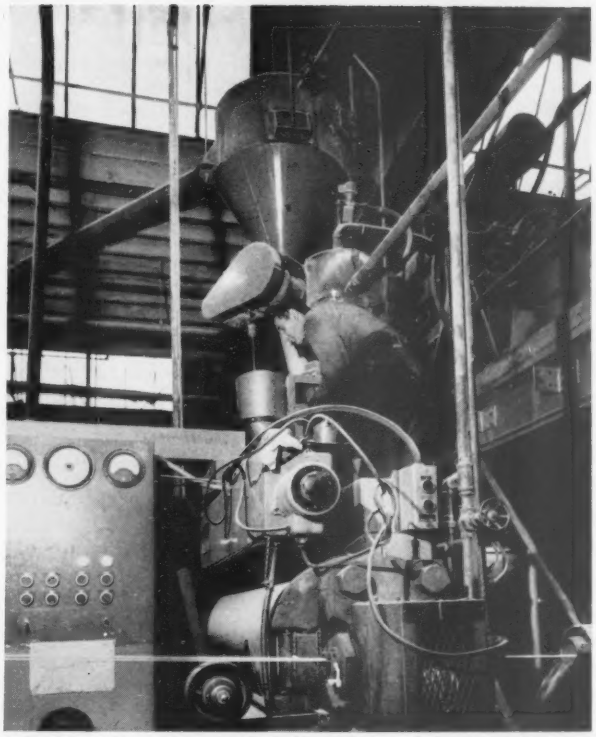
* * *

The system automatically maintains a constant 600-lb. minimum supply of PVC at each extruder hopper throughout three shifts. This sort of handling efficiency enabled the company to step up extruder performance to a point where they insulate wire at speeds in excess of 2,000 fpm, a productivity rate that, as the company points out, excels the norm for that industry. Furthermore, provision has been made for adding three more extruders, an improvement that promises even better production capacity, yet requires minimum engineering and **no increase in the work force.** Under previous handling procedures twice as many men would have been needed to keep up with the supply

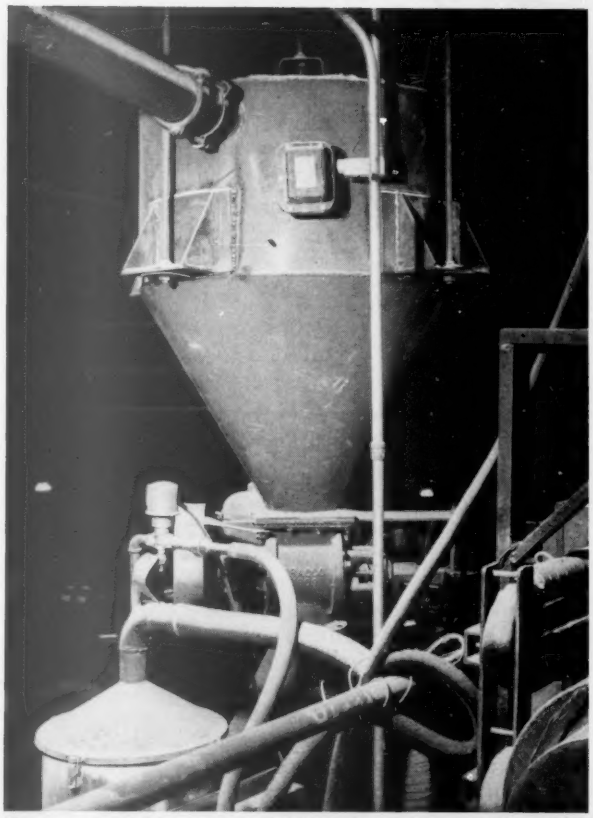
Airstream Conveyor simultaneously cools and moves hot PVC compounds to storage. Extra large conveying line facilitates cooling action, by which temperature of materials is reduced 100°. * * * * * * * * * *



Mixed PVC, enroute to storage, enters roof-mounted Multi-Bag Filter via 18-inch conveyor line at right. Dust collector is used here instead of conventional receiver because the expansive volume of air being circulated through the extra large conveying line requires more filtering area. Three-way distributor under filter hopper directs standard PVC mixtures to the 30,000 lb. storage bin below, or special formulas to a smaller hopper. Third duct provides readily available distribution component in the event a third storage facility is added. * * * * * * * * * * * * * * * * *



Conveying system moves PVC from storage to hoppers serving each of six extruders. Hoppers, like one above, are kept constantly supplied, thus permitting extruder operators to give full attention to machine operation. * * * * * * * * * * * * *



Close-up of extruder hopper. Unique arrangement of interior piping enables system to automatically maintain 600-lb. supply level at each machine. Bin indicator signals when refill is needed and starts conveying action. * * * * * * * * * * * * *

demands of the high-speed extruders.

Incorporates Unique Design Arrangement

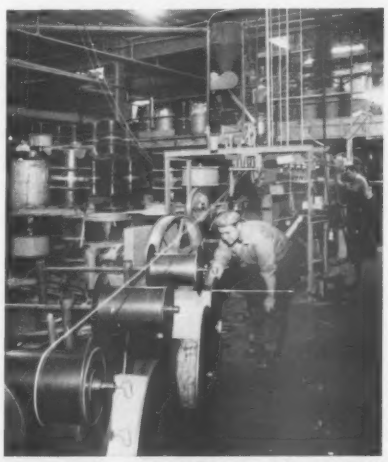
The conveyor brings PVC to process from a 15-ton storage bin. The conveying line, which makes a 350-ft. circuit through the processing area, connects with a hopper above each extruding machine. Extruder hoppers tap the line in series. For instance, when the first hopper has been filled to its 600-lb. capacity, the flow of material "automatically" moves on to the next hopper and so on until all are filled. Material left in the line then goes back to the storage bin. A low-level bin indicator on any one of the extruder hoppers can signal restart of the system.

* * *

Generally, when material flow must be diverted from a main line to another destination in a pneumatic system, a manual or remote controlled diverter valve is used to effect change in direction. At Circle Wire and Cable, however, an ingenious arrangement of piping effectively accomplishes diverting action.

* * *

As the conveying line enters each hopper it branches into an open-end and an offset piper. Material pours into the hopper from the open-end pipe and builds up within the hopper until it ultimately blocks off the opening. At this point capacity has been reached and flow goes on to the next hopper or back to storage.



Wire insulating and reeling operation at Circle Wire and Cable. Installation of pneumatic conveying system, background, enabled the company to step up extruder operation to a point where wire is processed at rates in excess of 2,000 fpm. Note how conveyor lines are positioned near the ceiling and away from production floor activities. * * * * * *

Cools and Stores Simultaneously

The pneumatic system is a process tool as well as a conveyor. A portion of it is incorporated with the blending process in which PVC is mixed with other ingredients and stored for eventual use in the extruders. The conveyor system simultaneously cools, and delivers these ingredients to storage bins.

* * *

PVC is mixed in a tank with other ingredients at 200°F and dropped by gravity into surge bins on the floor below. From surge bins materials enter the conveying line through rotary locks and are drawn at the rate of 7,000 fpm to a roof-mounted Multi-Bag Filter. Enroute, ingredients are blended and cooled to 100°F. As the material enters the Multi-Bag Filter it drops into the filter hopper where it is

(*Please turn to page* 1066)

Transport Organisation — The Economic Aspects in Relation to the Light Steel Industry

by Mrs. J. E. Haslam
Assistant to Traffic Manager
Rylands Brothers Limited
Warrington, England

A study of transport costs ought not to be attempted until the broad principles of transport organisation and law (including licensing) are understood.

* * *

Recent legislation, giving greater freedom to the railway to negotiate with individual traders on one hand—and the return to private enterprise of road transport interests on the other, has brought many changes in the field of transport.

* * *

There is also the rapid growth of foreign competition which makes the transport costs of exports more important than ever. This leads to the constant need of finding new methods of despatching and receiving, of controlling cost without lowering the standard of service, and the introduction of new ideas and practices.

* * *

When reading various transport journals the new methods may appear attractive, but when adapted to one's own products they may prove completely abortive. This means that more research must be undertaken but whether the results are negative or positive transport costs are an absorbing study, and an important one.

* * *

If an order is received and the production streamlined, the fact that the transport cost is too high can minimise the efforts of the production and sales departments. If this research is approached with the feeling that "it all depends on me" then the enthusiasm for one's job will never diminish.

Mrs. Haslam joined Rylands in 1952 as a Costing Clerk. She was later transferred to the Traffic Department, and then appointed to her present post. She presented this paper at the Staff School of Frederick Smith & Co. Wire Manufacturers Ltd., through whose courtesy it is published.

Observations on this subject are divided into ten sections in the hope that the approach to the subject may be easily followed:

1. Inwards
2. Inter-departmental
3. Outwards
4. Road
5. Rail
6. Inland Water Transport
7. Sea
8. Air
9. Warehousing
10. Statistics and Complaints

Inward Transport

The inward flow of traffic will be raw materials such as rods, spelter, fuel, ore and incidental goods such as packing materials, kegs and consumable stores.

* * *

If we take the most important of these — the rods — which usually originate from a limited number of sources, it may be that a haulage rate per wagon, rather than a rate per ton, will bring down the cost considerably.

* * *

Unfortunately, among the main factors to be considered since the railway new charges scheme was introduced is the demurrage and standage rate which has increased considerably. When costings are made it is important that this figure should be reflected back over the whole tonnage as it will make a considerable difference to the price of the rods if they are brought by rail.

If the alternative of road transport is used, the cost of carriage, plus the second handling and transporting to the cleaning houses at a later date, may be more than rail carriage and demurrage costs.

* * *

If rail connected, it is certainly very convenient to uplift the rods from the railway wagons or bogie-bolster wagons direct into the cleaning houses. A factor that will affect the cost is the regulation of the flow of rods. If the off-loading at the receiving end could be synchronised with the loading at the works despatching the rods, then the standage and demurrage charge would be virtually eliminated, but here the testing of the rods and also the small quantities of odd sizes required, apart from the railway practice of "bunching", makes this rather difficult. If too fine a margin is worked upon it would mean that any delay in transit—an accident on the line, fog, etc.—might mean the slowing down or in extreme cases the loss of production. However, the advantage of bringing rods in by rail is that they do not impede the outward flow of traffic and the railway wagons may be brought alongside the cleaning house, thus avoiding double handling.

Ore

Ore is usually brought in by rail, and as this is in large quantities an advantageous rate can be obtained. The railway provides sheets to keep the ore dry and the cost of these, plus the weighing of the ore, is not excessive. Standage on railway wagons will again enter into our calculations—so much depends upon the rate at which the ore can

be discharged and the prevailing weather conditions which can delay this operation if not under cover.

Packaging Materials

Packaging such as kegs, cases, etc. is usually brought in by rail and a certain amount of standage is unavoidable. For example, kegs must be ordered in advance of production and any change in programming may mean that the kegs are not unloaded at once.

* * *

If brought in by road they could be regulated and unloaded at the point of production, but care must be taken to ensure they do not obstruct the loading of other traffic.

* * *

We find, from experience, that the receipt of inward traffic by rail and the outward distribution by road is convenient and economical.

Inter-Departmental Transport

An important feature of transport in the light steel industry is the inter-departmental exchanges of raw materials, partly manufactured goods and in some cases the aggregating of part lots for despatch.

* * *

In an industry covering a large variety of products such as nails, netting, barb, fence, rope and various types of wire, one cannot expect that all departments will be adjoining the wiredrawing mills, which are where the manufacture of any wire product must commence.

* * *

When a new works is laid out, it is very much easier to plan the departments so that movement between them is kept to a minimum, but when a firm has been in existence for a great many years, and gradually developed, the cost of inter-departmental traffic enters very much into the overall cost of production.

* * *

If departments are adjoining then ram trucks and listers can be very economically employed. For the movement of articles such as cartons, barb, wire etc. the use of pallets in conjunction with fork lift trucks will make for quicker and cheaper handling. It may be that a system of conveyor belts could be used to take coils (provided they are of limited weight) from one department to another. These could either be in a flat position a few inches from the ground or in a perpendicular position on a series of hooks. Another method of handling would be the use of slings and overhead cranes, or electrically operated gantries with a U-shaped hook to carry several coils at a time. Each of these ideas should be investigated, especially from the point of view of cost and convenience.

* * *

To move larger quantities of wire etc. a series of articulated vehicles can be employed. The "flats" can be placed at appropriate points, and the wire loaded on to them at the convenience of the department. One mechanical horse can be used in conjunction with two or three flats. This is a great economy, as it means that the cost of one driver's wages will cover the movement from two or three departments, and that the "standing time" charge on two or three lorries will be avoided. Moreover the size and maneuvrability of these articulated vehicles make them a very attractive proposition especially when working in limited spaces.

* * *

Under unified control, the best possible use can be made of this articulated fleet, and the maximum economy effected.

Outward Despatch

There are many factors entering into the outward despatch of goods, such as the flow of traffic in one direction, the weight of the consignment, if a daily service is available, whether a special container is required and last but not least, if the customer specifies road or rail. The competition between road and rail transport still continues, and the various rating systems will be discussed in later paragraphs.

Small consignments

One of the biggest problems of outward despatching is the rise in the number of small consignments. In a world beset by inflation, deflation, rumours of depression, policies of Foreign Governments, it appears to be a growing tendency of many customers to order lesser quantities more frequently.

* * *

On the production side, some departments may make "token" despatches to customers, and this gives rise to further small consignments which have an adverse effect on the overall transport costing; for example, if a customer ordered 50 tons of wire, and it was aggregated, the cost would be 50 x X shillings. If part lots were despatched, say in two 14-ton lots, two 10-ton lots, one 1-ton lot and two of 10-cwts. the cost would be as follows:

28	(x + 3d.)	=	28x + 84d.
20	(x + 4d.)	=	20x + 80d.
1	(x + 6d.)	=	x + 6d.
1	(x + 10d.)	=	x + 10d.
			50x + 180d.

Therefore the transport would cost 15/- more because of part-lot despatching.

* * *

It seems unlikely that either the Railway or Road Transport want to carry these smalls, for they usually require trans-shipment. As the cost of labour is high it means that very little, if any, profit is made on the transaction. There is the alternative of Passenger train service, or road transport parcels service, but the costs of these are both high and on a product such as wire, out of proportion to what the traffic will bear.

* * *

Apart from the angle of cost, the small consignments have a nuisance value, as they have to be kept separately in the warehouses, consequently, if other orders have to be warehoused away from the works, this will mean extra costs again.

* * *

The solution to the problem is not easy to determine, and what may be the answer in one firm is not necessarily the answer in another works. Therefore, one can only point to the various methods of dealing with small consignments and leave it to the reader to decide which may be the most appropriate in the particular circumstances.

* * *

One approach might be by the requisitions to the Traffic Department. If these could be available at least 12 hours before the wire was

ready for despatch, the small consignment can then be married up whenever possible with despatches from other departments and a lower rate obtained.

* * *

It could be an advantage to have a central despatching warehouse for small consignments. This is attractive from the cost point of view (aggregation for rating) but it could lead to delay in despatches, and the system of registration of consignments in the warehouse would have to be extremely carefully supervised. The production warehouses would be kept clear, but whether the double handling, the extra clerical labour involved and the cost of inter-departmental transit would be offset by the lower rates paid on the consignments, is a matter to be investigated.

* * *

With an increase of these small despatches more and more traders are turning to effecting their own deliveries, either by "G" licensed vehicles, or by hiring vehicles on a contract basis. This should be given careful consideration. The favourable features of having control of vehicles is that the urgent requests of customers can be met, the drivers gain knowledge of the handling of the product, and the customers, and such lorries have an advertising value. On the other hand, unless used to capacity or for the small consignments which carry high rates, the costs may not compare favourably with alternative service by private haulers.

Road Transport

The cost by road is a comparatively easy matter to ascertain. Contractors are usually willing to quote a flat rate to cover all weights to industrial areas such as Birmingham, London, Glasgow, which are likely to have a fairly regular stream of traffic. From the hauler's point of view, this traffic will be attractive as he can probably make arrangements with firms in that area to "back load", and this would avoid the vehicle running empty on the return journey. A flat rate also facilitates the checking of accounts as it only entails one monetary extension for the total tonnage, rather than individual extensions at varying rates for each consignment.

* * *

For other traffic which is not covered by this block rate, the road carrier will usually quote a range of charges based on the mileage, and the weight of the consignment.

* * *

In many cases, the road hauler has an advantage over the Railway, in that he need not provide terminal accommodation for the traffic at either end. He is not responsible for the upkeep of the permanent way (the roads) although he may pay heavy taxes. There is not the maintenance of buildings, plant and signalling. Unremunerative clerical work can also be kept at a minimum. All these factors must have a bearing on the charges raised.

* * *

The main type of licensed vehicle used by industry is the "A"' license, Contract A, sometimes "B" License and the 'C" License vehicles. The "A" License vehicles provide the normal road haulage service, and a rate either on a tonnage or flat rate basis is usually quoted.

* * *

The Contract "A" License is an entirely different proposition from a cost point of view, as it is restricted to a particular vehicle and user. Consequently, it will be reasonable to expect that the cost may be higher. A fixed charge per week may be made to cover insurance maintenance and the driver's wages, plus, in addition, a specified mileage. The driver's overtime cannot be assessed in advance, so this amount plus any additional mileage will vary from week to week. However, if reflected back over the tonnage carried, any variation in cost will be clearly shown.

Example

	Week 1	*Week 2*
Hiring, fixed charge	£25. 0. 0d.	£25. 0. 0d.
Overtime.	3. 0. 0d.	4. 0. 0d.
Excess Mileage @ 9d per mile	1.13. 9d.	1.17. 6d.
	£29.13. 9d.	£30.17. 6d.
Total Tonnage	21½ tons	28 tons
Cost per ton	£ 1. 7. 7½d.	£1 2s 0½d.

This reveals that although the overall cost of the vehicle for Week 2 was higher, the cost per ton was lower, and therefore the vehicle was employed more effectively.

* * *

Naturally there are many forms of contracts, and each manufacturer would have to decide which would meet his individual requirements most efficiently.

* * *

Over the past twenty years there has been a marked increase in the number of "C" License vehicles (an increase from 365,000 in 1938 to 1,070,000 in 1957). In arriving at the cost per ton, allowance should be made for maintenance, insurance, garaging, driver's wages, tax etc. The total outlay can then be reflected back over the tonnage carried.

* * *

When a Contract "A" License or a "C" License vehicle is employed it can be painted with the name of the hirer or owner, and this would have an advertising value which it would be difficult to express in monetary value.

* * *

A comparatively new innovation is the introduction of the through Ferry Service to Northern Ireland and the Continent. For larger consignments the cost will bear comparison with the alternative routes either on a "through" railway rate or by road to the steamship companies' docks. The goods are loaded either on to a flat of an articulated vehicle or a container, and these are carried on the specially constructed craft for direct delivery to the customer. There is little risk of delay or damage in transit and therefore this service has much to commend it. In most instances the rates quoted will stipulate a minimum charge, therefore it is only economical when applied to larger consignments or goods of a higher classification.

It is not easy to predict the future of Road Transport as it is subject to change at the will of the

Government. The recent nationalisation and the de-nationalisation is a good example of this.

Rail Transport

When considering outward despatch by rail, there are two ways in which this can be effected: —

a. **The goods can be carted to the station.**
b. **They can be despatched direct from the Siding.**

* * *

When traffic is despatched via the station, the rate quoted will be s/s (station to station), s/d (station and delivered) or c/d (collected and delivered), and these qualifications can make all the difference to the transport cost. Where a rate is s/s or s/d, the local cartage rate may raise the "through rate" to an uncompetitive level.

* * *

From our own experience we have found it attractive to hire a railway articulated vehicle on an annual basis to cart goods to the station. A "flat" can be parked (in the same way as for internal traffic), and loaded while another "flat" is en route to the station. Here again it is essential that this vehicle is used to capacity, in order that the cost reflected back over the tonnage moved will be less than the local cartage rate. Alternatively, it may be found that the firm's own vehicles can perform this service at less cost.

* * *

In respect of small consignments, the new Railway Scale of Charges only quote c/d (collected and delivered) rates, and if the manufacturer performs his own cartage no rebate is allowed.

* * *

When despatching by rail there are, in addition to the ordinary scale of rates, "exceptional" rates —usually given for volume or frequency of traffic and any such rates used between 1955 and 1957 might well be continued if lower than the new scale. New exceptional rates may still be obtained from the Railway in special circumstances. As the result of recent legislation the railways have been given greater freedom and may quote different rates to individual traders for similar traffic from the same area. Therefore considerable skill is needed to negotiate these rates.

* * *

The Railway may be willing to quote a flat rate for goods of any weight despatched all over the country, and this is known as an "Agreed Charge". (There may be exceptions, such as Irish Traffic, returned empties etc.) Periodically, the railway will take a test month and review the charge.

* * *

The advantage of an Agreed Charge is two fold in that the carriage will be known in advance, and that the checking of accounts is facilitated.

* * *

The alternative method of despatching from the sidings is one that at first glance will appear to be attractive, as the local cartage rate may be avoided, and in some cases a small rebate may be claimed. However, this is not the complete picture. There is the rental of the sidings (unless privately owned), the charge for maintenance and facilities provided by the railway, and also the cost of locomotives required for internal shunting. Another incidental cost will be the demurrage on the wagons requisitioned for loading.

* * *

These various costs should be reflected back proportionally over the whole of the traffic dealt with in the sidings. To ascertain if the siding is an asset or a liability economically, it is necessary to review the costs periodically, taking into account, however, the convenience provided by the use of the sidings.

* * *

Running parallel with the modernisation scheme, the railway has made many innovations — "The Express Freight Service", "The Container Service to Northern Ireland" and many other ideas. All these should be investigated with the idea of providing a better service for the customers at not too great a cost. Although not a new idea, the "Green Arrow Service", by which a consignment is "wired" forward for a nominal sum, has proved to be a very good system. One cannot hope to include all the services provided, but many are very worthy of consideration.

Inland Water Transport

The main drawback to the use of inland water transport is that the Works should be adjacent to or very near the canal or river. If this is not so, the cost of double handling plus cartage will make the rate uneconomical. Apart from this, the rates quoted are quite competitive. However, barges are usually employed for large volumes of traffic, and therefore they are not a great deal of use for the despatching of normal consignments of varying weights.

* * *

When there was a steel shortage and we were forced to import rods, we did find that by taking delivery of the rods overside into barges, quay porterage and railway demurrage at the docks were avoided. A through rate was quoted from the Continent to our works and this was found to lessen the cost considerably.

* * *

The rods were brought by water to the wharf warehouse, and we were able to take them into our works at our convenience. Only a nominal rent was paid, and congestion in the sidings or at the works departments was avoided.

* * *

If we had used rail transport, no doubt we should have incurred considerable demurrage as the railway would have brought the traffic forward in one train load. Alternatively, if we had employed road transport we should have run the risk of congestion in the works as well as the cost of double handling and, additionally, internal transport.

* * *

As far as outwards transport is concerned, barges can be loaded to deliver goods alongside the ships, but unless a considerable tonnage is exported as one consignment, it will not be economically attractive.

Export Transport Costs

When considering exports, cost is, of course, quite an important factor, and not least of these is the cost of transport to the ports. There is the fact that after the

(*Please turn to page* 1059)

The Annual Convention

of

THE WIRE ASSOCIATION

October 22-26, 1961, French Lick-Sheraton Hotel, French Lick, Ind.

TENTATIVE PROGRAM SCHEDULE

Sunday Evening, October 22

President's Reception to Members
Registration Desk opens at 2:00 P.M.

Monday, October 23

10:00 A.M. — Meeting of Board of Directors
12:30 P.M. — Directors' Luncheon to Program Participants
2:00 P.M. — Joint Opening Session
1. President's Address of Welcome
2. Presentation of 25-Year Certificates
3. Mordica Memorial Lecture
4. Technical Papers of General Interest
5. Annual Meeting of Association Members

8:30 P.M. — Horse Racing — movies and "betting" (no money)

Tuesday, October 24

9:00 A.M. — Technical Sessions for the Three Divisions — 4 papers each.
1:30 P.M. — Meeting of the Electric Wire & Cable Management Committee. Otherwise free for recreational activities.

Wednesday, October 25

9:00 A.M. — Technical Sessions for the Three Divisions — 4 papers each
Afternoon — Open for recreational activities
6:00 P.M. — Hospitality Hour (Pay-as-you-go basis)
7:00 P.M. — Annual Banquet
1. Presentation of Awards
2. After-Dinner Address

Thursday, October 26

Convention closes. Guests free to leave for home. *No further official activities.*

All meals and rooms are included in the hotel's American Plan guest charges, to which will be added 15% by the hotel to cover gratuities.

Registration Fee: Members $15.00 — Guests $18.00 — Ladies $5.00

This first Annual Convention in a resort hotel promises to be a highly interesting and refreshing change from our routine procedure of meeting in one of the larger industrial cities. We shall welcome all wire men, whether members or guests.

THE WIRE ASSOCIATION

Richard E. Brown, Executive Secretary

453 Main Street **Stamford, Conn.**

ADDITIONAL PROGRAM DETAILS
of the
ANNUAL CONVENTION OF THE WIRE ASSOCIATION

On Sunday evening, October 22nd at 8 o'clock there will be a President's Reception to members to give those in attendance an opportunity to become acquainted prior to the opening of the formal program on Monday.

On Monday afternoon at the opening session, *David M. Schmid,* President of the Techalloy Company, will present the Mordica Memorial Lecture: "How Soviet Wire Mills Compare With those of the Rest of the World." Mr. Schmid, who recently returned from Russia, has combined his observations there with the results of other personal visits to European Mills. This Lecture should not be missed.

From 6:00 to 7:00 P.M. on Monday evening, a Hospitality Hour will be held sponsored by a number of suppliers.

The free afternoons on Tuesday and Wednesday will be open for any recreational activities that members and guests may elect, but golf and skeet shooting contests have been arranged, with prizes for the winners to be awarded at the Annual Dinner on Wednesday. A swimming pool (heated) will be open.

On Tuesday evening a series of movies on real horse races will be shown. Members and guests may "bet" on the horses with "phoney" money. Prizes will be given those who make correct selections.

Preceding the Annual Dinner Wednesday evening a pay-as-you-go Hospitality Hour will be held from 6:00 P.M. to 7:00 P.M., very much as in former years.

Following the dinner and the presentation of awards, a speaker of unusual interest will address the group. He is "The Man Who Led Three Lives" — Herbert Philbrick, American citizen, "Communist," Counterspy — who will talk on his experiences in exposing the activities of Communist Cells.

An interesting Program for the Ladies also has been set up, so that time will not be heavy on their hands while the men are busy with the technical end of the program.

The foregoing are some of the highlights of the Program of events that the Program Committee has arranged for the enjoyment of all present.

This year things will be pleasingly different. Don't fail to come to French Lick in October.

THE WIRE ASSOCIATION

Richard E. Brown, Executive Secretary

453 Main Street **Stamford, Conn.**

Report On Available Standard Samples and Related Materials For Spectrochemical Analysis

Another aid to scientists studying materials is announced by the American Society for Testing Materials with the publication of a "Report on Available Standard Samples and Related Materials for Spectrochemical Analysis."

* * *

The information is published in this volume to provide ready reference to the availability and sources of standard samples, reference samples, and high-purity materials. The listing of high-purity materials provides useful information to the analyst, particularly in the preparation of standards in the laboratory when other suitable standard samples are not available.

* * *

Quantitative spectrochemical analysis is based on comparison of unknown samples with standard samples of similar composition. Standard samples frequently are prepared by the analyst for the particular problem in hand, but, for the analysis of many common materials, particularly metals and alloys, standard samples have been prepared in quantities adequate for general distribution. The rapid growth of spectrochemical analysis and a corresponding increase in available standard samples call for a periodic compilation of types and sources of standards for the information of analysts.

* * *

The total number of entries of standard samples, reference samples, and high-purity materials in this report is 3400; this represents an increase of 1300 in the five-year period between revisions. Among the materials covered are: base metal and alloys of aluminum, iron, magnesium, zinc, lead, tin, copper, nickel, cobalt, titanium, and zirconium. Also covered are ceramic materials, steels, metallo-organic, Diesel-oil contaminants, and metal powders.

Copies of this book may be obtained from ASTM Headquarters, 1916 Race St., Philadelphia 3, Pa., at $3.75 each.

New Polyamide Fiber Announced

A pilot plant for the production of a unique Du Pont fiber will be constructed at Richmond, Va., the company announced.

* * *

The new facility, to be completed in 1962, will produce HT-1, a high-temperature-resistant polyamide which shows great promise in industrial uses including electrical insulation, filtration of hot gases, special-duty beltings and reinforcement of high-temperature hose.

* * *

The company said the new HT-1 fiber is a product of more than 12 years of research originating in its Pioneering Research Laboratories here. The development work on HT-1 has been carried forward at Du Pont's Benger Laboratory located at Waynesboro, Va.

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Wire Machinery Builders Meet in New York

At a meeting of the Wire Machinery Manufacturers Association on April 26 in New York City, the gathering was addressed by Frederic B. Krafft, Chief Mechanical Engineer of the Anaconda Wire & Cable Company, who advised that "Instead of producing machinery that is built to last 50 years, build machinery with the knowledge that much of the equipment you make this year will be completely outmoded — either as to the end of product it is capable of producing, or to its capability — within 10 to 20 years."

* * *

He also cited a number of his company's principles with respect to wire machinery, that he recommended for the group's consideration. These were:

"Use light tubing and simple weldments that will serve the purpose as well as heavy castings.

* * *

"Utilize inventiveness and ingenuity, develop wire and cable equipment to reduce our investment costs and simplify our machines.

* * *

"Get off the glamour binge. Our needs are for simple, functional machines. Whenever we can avoid complex, electronic innovations that mean problems for our maintenance departments, we want to do so.

* * *

"Design reliability into your equipment. Build your equipment so every part will last the pre-determined lifetime of the machine.

* * *

"Consider total productivity. Machine designs should include human factor studies of the capabilities that should be expected of a well-trained operator.

* * *

"Plan for flexibility. Equipment should be designed to meet the challenge of constant change by building flexibility into machines that can be adapted to new products or new variations of old products."

Gigantic Market for Aluminum Powder in Missiles

Many of the nation's most reliable rockets — Polaris, Pershing, Scout and Mace — use fuels pepped up by addition of tiny atomized aluminum grains. Ranging in size from 5 to 8 microns, more than 780,000 grains

For Moisture Resistance, Specify

TEXTILENE

TWI-FLEX and TWI-WAX

Treated to reduce wicking and prevent leaching, lightly waxed Textilene Twi-Flex and heavily waxed Textilene Twi-Wax provide effective resistance to moisture. Both fillers are extensively employed for non-metallic sheathed cable (building wire), maritime shipboard cable, varnished cambric cable, and underground service entrance cable.

Twitchell's superior Textilene line also includes: Soft, dry fillers — *Twi-Port* and *Glascor** (Fiberglas-centered for high tensile strength without added bulk). Used for control, power, appliance, coaxial and communications cables, and all portable and flexible cords. Fungus-resistant filler — *Twi-Tar*. Used for buried communications cable, expanded ACSR cable, and in other applications.

*Patent Applied For

For Every Wire and Cable Application
Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

Assured supply from a reliable domestic source . . . always available in economical and convenient packaging.

Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation — also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

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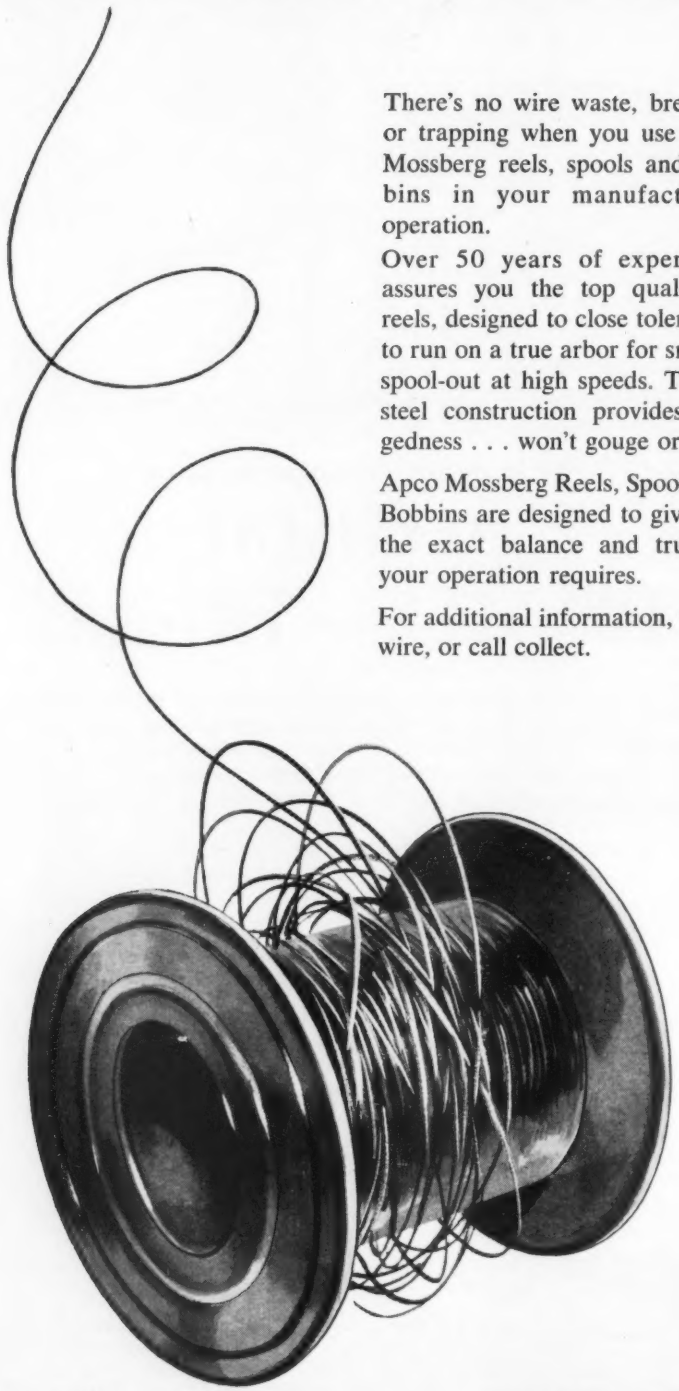
No wire waste!



There's no wire waste, breakage or trapping when you use Apco Mossberg reels, spools and bobbins in your manufacturing operation.

Over 50 years of experience assures you the top quality in reels, designed to close tolerances to run on a true arbor for smooth spool-out at high speeds. The all steel construction provides ruggedness . . . won't gouge or burr.

Apco Mossberg Reels, Spools and Bobbins are designed to give you the exact balance and trueness your operation requires.

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will rest easily on the 1/4" diameter head of a carpet tack.

* * *

The picture, 14 times actual size, was taken by a macro (cq) camera at the metallurgical research division of **Reynolds Met-**

als Company. Reynolds supplies millions of pounds of this fine powder to makers of rocket fuels. It is estimated that by 1965 35,000,000 pounds of aluminum powder will be used annually in this manner.

New Heat-Shrinkable Tubing Developed

The development of a radically new type of tubing that shrinks to form a tight mechanical bond within 7 seconds following application of heat, (275 degrees C), has been announced by **Alpha Wire Corp.**, 200 Varick Street, New York 14, N. Y.

* * *

Marketed under the name of Alphlex Shrinkable Tubing, the new tubing is an irradiated, flame-retardant, thermally stable, modified polyolefin base product, with applications limited only to the imagination of the design engineer.

* * *

The tubing is manufactured in an expanded form so that it may be easily slipped over wire and cables, hosing, terminals or conduit. When heat of approximately 275 degrees F. is applied, the material shrinks to a reduced, pre-determined diameter forming a secure, tight-fitting bond. Longitudinal shrinkage is less than 10%.

Alphlex Shrinkable Tubing is marketed in standard packages of 25 four foot lengths. Sizes 24 through 4 are available in black, white, red or yellow; other sizes, colors and lengths may be obtained on special order.

* * *

An Electronic Engineers Experimenter's kit of Alphlex Shrinkable Tubing and a descriptive catalog are available from Alpha Wire Corp., 200 Varick Street, New York 14, N. Y.

Eye Protection Chart

The American Welding Society has announced the publication of a chart giving the correct shades of glass to be used for proper eye protection in all welding and cutting operations.

* * *

The design of the chart enables the answer to be obtained immediately. On the left of the chart are the various soldering, brazing, cutting, and welding operations. On the right are listed the correct shade numbers to use for each process.

* * *

The operations are arranged in the order of increasing shade numbers. Soldering, therefore, with a relatively low light intensity, is listed first. The shade numbers increase as the light intensity increases until the highest shade number is reached when carbon-arc welding is used.

* * *

These Lens Shade Selector Charts are intended for display in welding shops in order that maximum eyesight protection may be given. Copies are available at 50 cents each, or 10 charts for $4.50, from the American Welding Society, Technical Dept., 33 West 39th St., New York 18, N. Y.

New Zinc Brightener

Reports from more than 250 platers using "ROHCO 503" Zinc Brightener emphasize the unique advantages offered by the latest technological development of **R. O. Hull & Company, Inc.,** Rocky River, Ohio.

* * *

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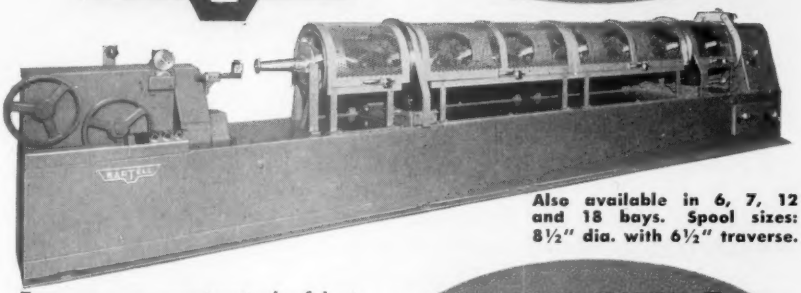
BARTELL FOR THE BEST



Also available in 6, 7, 12 and 18 bays. Spool sizes: 8½" dia. with 6½" traverse.

BARTELL SEVEN BAY HIGH SPEED STRANDER MODEL 7B-58-15

Frames are constructed of hot rolled shapes and plates to form a rigid box structure. Barrel is extruded 6062T-6 aluminum — Smooth starts through slip clutch driven by 7½ H.P. motor — Operators control station at front of machine — Main power control center at drive end — Electronically controlled automatic stop energizes solenoid operated brakes in event of wire breakage — Spool cradles and associated parts are completely interchangeable from one machine to another — Tungsten carbide wire guides throughout — Lay from ¼ in. to 5 in. long.

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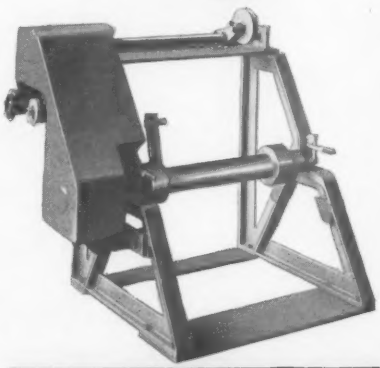
BARTELL TAKE-UP



This Take-Up is belt-driven, the drive originating from a slip clutch located outside the capstan box. Electrically operated traverse adjustable from zero to maximum reel width. Accommodates reels up to 30" dia. Speed selector sheave adjusts lay on reel to suit diameter of finished strand.

WE ALSO DESIGN AND BUILD SPECIAL EQUIPMENT TO MEET SPECIFIED REQUIREMENTS

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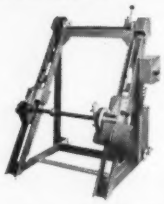
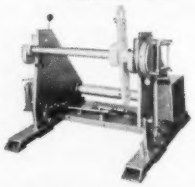
IS ESSENTIAL TO EVERY WIRE PROCESSING LINE!

During nearly half a century of ENTWISTLE Experience in the evolution of wire processing machinery, and in close cooperation with the wire and cable industry, a multitude of pay-off machines have been custom-built to specific performance and applicational criteria. From selected types of shaftless, shaft-type and stationary-reel pay-off machines, ENTWISTLE has developed standard designs with suitable options of power lifts, brakes, drives and control systems to satisfactorily perform in practically any pay-off application.

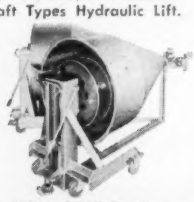
To be sure of proper support, control and supply of wire in your next pay-off requirement, ask about the ENTWISTLE Pay-off for your specifications.



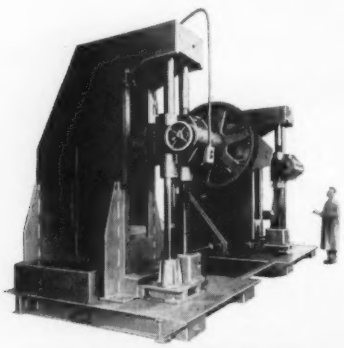
36", 48", 60", 72" and 84" Shaft Types Pneumatic Lift.



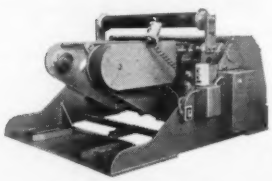
42", 48", 60", 72" and 84" Shaft Types Hydraulic Lift.



22", 30" and 36" Continuous Dual Pay-Off



20 TON X 120" SHAFTLESS MOTORIZED LIFT.



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British Associates	THE KEMSON ENGINEERING CO., LTD.	Blackburn, Lancs., England

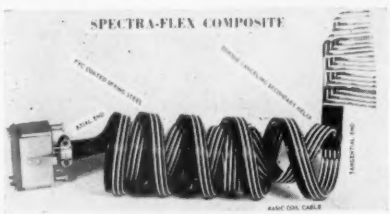
range of sizes and shapes, under various environmental conditions, ROHCO 503 performed with top efficiency in both still and automatic tank plating. It is reported to produce exceptionally uniform, high-quality deposits, meter-tested as degrees brighter than by any other similar processes. In conduit boxes and items having deeply recessed areas, corners, crevices, seams, internal threads, etc., the brightener demonstrates strong throwing power to produce uniform plate thickness and quality in hard-to-plate areas. This solves the problem of wasting 2 to 3 times more metal in over-plating easy-to-plate areas.

* * *

It offers wide latitude of application and tolerates extreme conditions — extended range of current densities, higher operating temperatures, bath compositions, etc. This unique stability permits important cut backs in processing time and practically eliminates rejects due to substandard plating.

New Extensible Cable Announced

Spectra-Strip Wire & Cable Corporation has released data on their latest type of extensible cable. This cable consists of two multi-conductor, helical wound cables, one wound inside the other



and spiralling in opposite directions. This results in a flexible assembly with exceptional power of retraction and large numbers of conductors with Zero torque on the terminations.

* * *

Details from Spectra-Strip Wire & Cable Corporation, P. O. Box 415, Garden Grove, Calif.

Our Advertisers are Reliable Patronize Them

Outstanding Personalities of the Wire Industry

Named Orders Manager For Scott Testers

It was announced recently by **David C. Scott, Jr.**, Pres., that **Carl St. Onge** has been named Orders Manager for **Scott Testers, Inc.** of Providence, R. I., manufacturers of physical testers for textiles, rubber, plastics, paper, leather, wire and other basic industry products.

* * *

Mr. St. Onge joined Scott Testers in 1947, and for some time has been Parts Manager for the firm. In his new position, he will be in charge of processing of domestic and export orders, issuance of quotations, disbursement of sales commissions, dissemination of technical literature, and expediting of parts and service. He completed special studies at Brown University, R. I. School of Design, Bryant College, and the University of R. I.

Newton Appointed Superintendent

R. C. Planeta, Sr., President of **Artistic Wire Products Co., Inc.** of Taftville, Connecticut, announced the appointment of **Douglas H. Newton** as Plant Superintendent on May 8th.

Douglas H. Newton

* * *

Mr. Newton will be responsible for manufacturing, production scheduling and personnel in his new assignment.

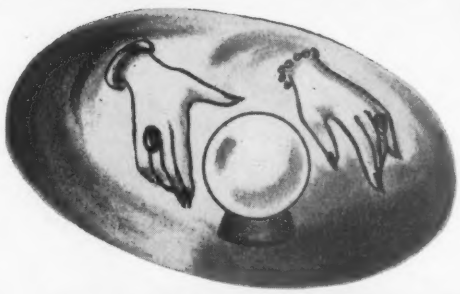
* * *

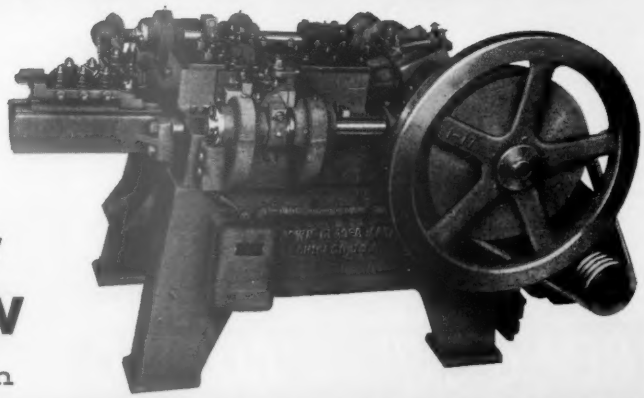
He was formerly Plant Superintendent for Ponemah Mills at Taftville, and Plant Manager of Futurity Thread in Newton, Mass. He was educated at Fryburg Academy, Fryburg, Maine, and at the University of Connecticut.

Keystone Sales Appointments

Five important changes in the Merchant Trade Sales Division of the **Keystone Steel & Wire Company**, effective July 1, were announced by **D. A. Sommer**, General Sales Manager, and **W. H. Getz**, Merchant Trade Sales Manager.

IF THERE'S A NAIL MACHINE IN YOUR Future make it a GLADER





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Cecil H. Hawkins, of Peoria, Illinois, will assume direction of the company's San Leandro, California, warehouse operations, following the retirement of **C. E. Simon.** Hawkins came to Keystone in 1935, served as sales representative for 13 years in the Salt Lake City, Utah, area, and since 1949 has been District Sales Director, West Coast Division.

* * *

Stanley Brock, District Sales Director of Keystone's Southeast Division since 1936, assumes similar responsibilities as Sales Director for the West Coast Division formerly held by Hawkins.

* * *

Replacing Brock as Sales Director of the Southeast Division is **H. L. "Bud" Stonner,** presently sales representative for the Southern Ohio territory of the company. He joined Keystone in 1936. Both Brock and Stonner will headquarter at the firm's Peoria main office and plant.

Keith Sanderson, Pekin, Illinois, acquires the Southern Ohio territory relinquished by Stonner. Sanderson has served as a sales assistant in the company's Peoria offices since 1956.

* * *

Completing the sales changes at this time is a territorial addition to **Lee Gramm,** sales representative headquartered at Bushnell, Illinois. Gramm, who will service eleven additional central Illinois counties, has been associated with Keystone since May, 1950.

Mathematics Expert Joins YS&T

Dr. William H. Ceckler has joined **The Youngstown Sheet and Tube Company's** research and development department as supervisor of applied mathematics and operations research.

* * *

He is the eighth specialist to be named to the company's research staff in recent weeks in an expansion directed by **Dr. Karl L. Fetter,** vice president-research and development.

* * *

Dr. Ceckler's assignment involves the application of mathematics and computer techniques to iron and steelmaking practices. He also will work on studies now in progress concerning product distribution and warehousing, with eventual work planned to help solve production scheduling problems.

* * *

He graduated from the University of Rochester and earned his doctor of science degree in chemical engineering from the Massachusetts Institute of Technology, serving as assistant professor in MIT's chemical engineering department for two years.

Bristol Brass Promotions

Joseph O'Brien has announced the promotion of three men to new positions in the company. **Donald Gay** has been made Vice President-Sales, **Joseph T. Has-**

Marking Machines, Wheels & Inks

FOR INSULATED WIRE, TUBING AND PIPE—

Type AM — Illustrated has these features:

1. FINE VERTICAL AND HORIZONTAL ADJUSTMENTS PROVIDE PERFECT MARKING ON WIRES OF .010" TO 3.00" IN DIAMETER.
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Actual Production Photo of Type AM

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West Germany: Walter G. Fritzke GMBH, AM Wehrhahn 94-96, Dusseldorf, W. Germany
Warbrick Engineering Specialties Limited, Barclays Bank Chambers, Sanky Street, Warrington, England.

sett has been appointed Vice President and Works Manager and **C. Harvey Gustafson** has been named Administrative Assistant to the President.

* * *

Mr. Gay had been General Sales Manager since 1951, Mr. Hassett joined the company in 1940 and rose through a series of posts to General Superintendent, and Mr. Gustafson, who rejoined the company in 1953 after service in the U. S. Army, will continue his responsibilities of managing the company's insurance and metal buying.

Cleveland Tramrail Appoints Jensen

Vernon B. Jensen has been appointed District Manager for the **Cleveland Tramrail and Steelweld Machinery Divisions** of The Cleveland Crane & Engineering Co., Wickliffe, Ohio, in the Cleveland, Toledo and Detroit areas. Mr. Jensen previously was with the Cleveland Tramrail Distributor organization in San Francisco, California, as sales and project engineer for Cleveland Tramrail cranes and monorail systems.

Vernon B. Jensen

Crucible Research Man Honored

Peter Payson, Assistant Director of Research with **Crucible Steel Company,** received an honorary Doctor of Engineering degree from Stevens Institute of Technology on June 10 for his achievements in the field of metallurgy. From 1941 until 1955 he served as Adjutant Professor of Metallurgy at Stevens' Graduate School.

* * *

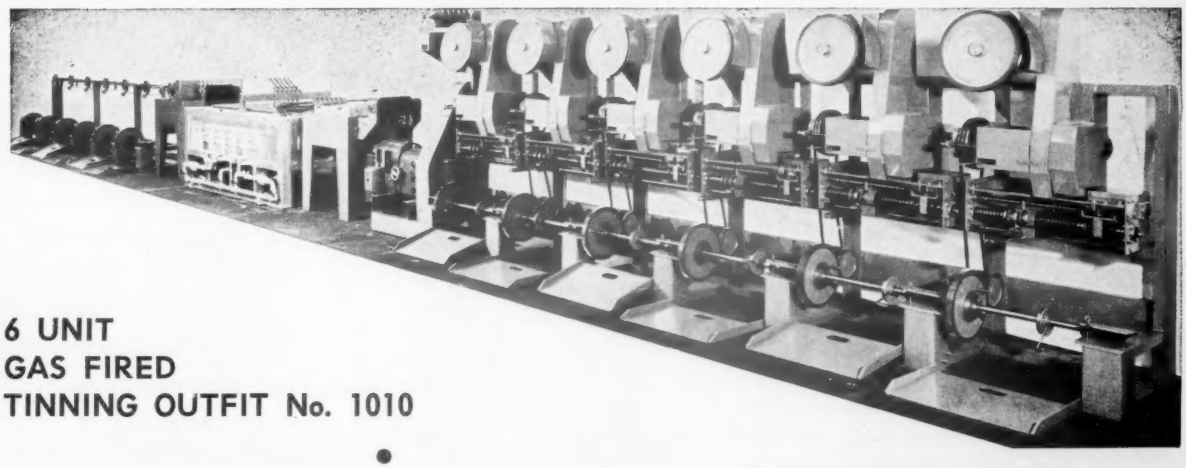
Mr. Payson presently is completing a book on "Metallurgy of Tool Steels." He holds 36 U. S. patents and is the author or coauthor of 17 papers on various phases of steel metallurgy. In 1958 he was accorded the honor of delivering the American Society for Metals' Campbell Memorial Lecture.

* * *

He joined Crucible in 1923 as a Metallurgist at the Company's Sanderson-Halcomb Works in Syracuse, N. Y. In 1929 he was transferred to Harrison, N. J., to head the newly organized Company Research Laboratory. He remained there for the next 26 years as Chief Research Metallurgist and later as Assistant Director of Research.

* * *

Mr. Payson is a graduate of Columbia University where he received a B. A. degree in 1920



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FAIRHILL AND HUNTINGDON STREETS
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and one in Metallurgical Engineering in 1922.

Tubing Firm Announces Appointment

Appointment of **G. William Loveday** to the newly created post of Manager—Product Planning, **Flexible Tubing Corporation,** Guilford, Conn., has been announced by **Frederick K. Daggett,** president.

* * *

Formerly assistant to the president for technical sales, Mr. Loveday will now be responsible for Flexible's market research program. He will also be responsible for origination and coordination of research, development and design projects and programs developing from current market requirements.

Dove Honored by AISI

At the 69th General Meeting of the **American Iron & Steel Institute** in New York in May, **Allan B. Dove** was presented with the Regional Technical Meeting Award in the field of operations for his paper, "The Cleaning of Carbon Steel Wire as Affected by the Metallurgical of the Slag."

* * *

Mr. Dove, long a member of **The Wire Association,** served as its president during the years of 1959 and 1960 and presently is a director and Chairman of the Board of Past Presidents. He delivered the Mordica Memorial Lecture in 1949 and presented a paper at the Association's Annual Convention in 1955, for which he received from the Board of Directors the Medal Award for the best Ferrous Division paper of that year. Mr. Dove is Product Development Metallurgist for the Steel Company of Canada Ltd., Hamilton, Canada.

Allan B. Dove accepting Regional Meeting Technical Award from AISI President Benjamin F. Fairless.

G. E. Appoints Two To Management Posts

Two Schenectady, N. Y., men have been named to managerial posts at **General Electric's Silicone Products Department.**

* * *

William C. Giegold has been named manager of quality control and **Frank V. Summers** has been promoted to the post of manager of intermediates process engineering.

* * *

Mr. Giegold is a graduate of Georgia Institute of Technology, where he received a bachelor's degree in chemical engineering. He joined General Electric following his graduation in 1947 and

New! Improved! Fast!

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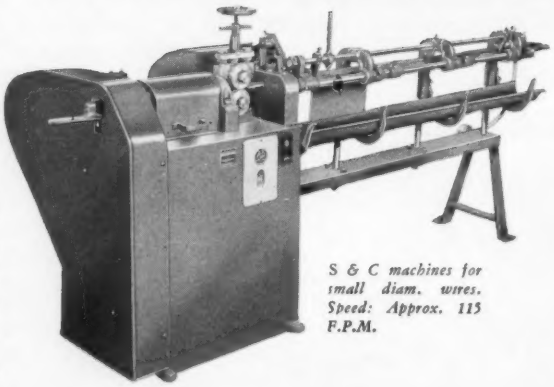
STRAIGHTENER & CUTTER



S & C machines for small diam. wires. Speed: Approx. 115 F.P.M.

This completely redesigned line combines maximum efficiency with that rugged dependability, for which WELLS S & C machines have become justly famous.

Built in several sizes to handle 2 to 18 ga. basic and high carbon wire.

FEATURES

The guide bar of these new machines can be supplied for any cut lengths ● The rotary flier runs on ball bearings for smoothness and long life ● Cut-off is actuated by a solenoid for extreme accuracy of cut lengths ● A two point cam construction provides a quick and positive return of the cut-off knife, eliminating the need for a clutch and dog ● A counter is standard equipment.

A COMPLETE RANGE OF S & C MACHINES IS MADE BY WELLS FOR ALL SIZES OF WIRE. SEND FOR CATALOG ON THE COMPLETE LINE.

Frank L. Wells Company

BUILDERS OF FINE WIREWORKING MACHINERY

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has served in subsequent various engineering posts in the Company.

* * *

Mr. Summers holds a bachelor's degree in chemical engineering from Iowa State University. He joined General Electric in 1949 on the Company's chemical and metallurgical training program. He joined the Silicone Products Department in 1952 as a process engineeer and was a process economics engineer at the time of his present appointment.

Firth Sterling Appointments

Firth Sterling Inc., Pittsburgh, Pa., has announced a number of organizational changes, effective June 1, 1961.

* * *

Harry J. Alverson, Jr. is elected Treasurer-Comptroller. In this function he assumes the responsibility for the financial management of the Company, in addition to his duties as Comptroller.

* * *

Clyde N. Gillespie is elected Secretary and Assistant Treasurer and in this capacity assumes the corporate functions of Secretary of the Company, in addition to retaining supervision over credits and collections.

* * *

David A. Tyree is elected Assistant Secretary. In this position he will assist the Secretary in corporate duties in addition to handling all matters of a legal nature as Manager of the Legal Department.

* * *

The above changes result from the retirement of **Herman R. Huemme,** Secretary-Treasurer of the Company, who retired after 45 years service to the Company.

Crucible Elects Vice Presidents

Daniel A. Porco and **Eugene A. March** have been elected vice presidents of **Crucible Steel Company of America.** Their election by the Board of Directors was announced by **Joel Hunter,** President and Chief Executive Officer.

* * *

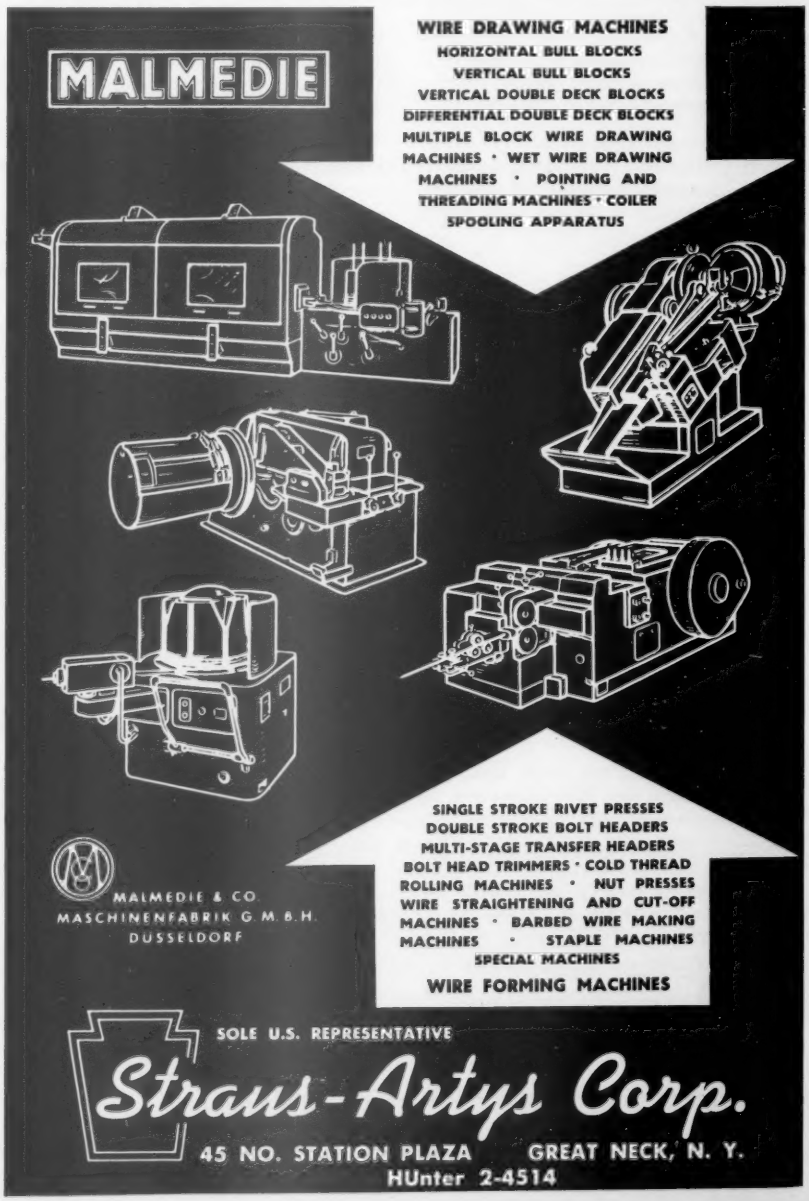
Mr. Porco was formerly Assistant to the President and Mr. March, who becomes Vice President of Technology, was formerly Director of Technology. He joined Crucible in 1950 as Supervisor of Standard Costs Installations at the Company's Park Works and in 1959 was made Assistant to the President. He is a 1947 graduate of the University of Pittsburgh with a B. S. in Business Administration.

* * *

Mr. March joined Crucible in 1946 as Metallurgist — Mill Control at the Company's Sanderson-Halcomb Works in Syracuse, N. Y. He was named Assistant Works Manager in 1957. He was graduated from Culver Military Academy in 1937 and Massachusetts Institute of Technology in 1941 with a B. S. degree in Metallurgy.

Machinery Firm Expands

General Engineering Co. (Radcliffe) Ltd., Radcliffe, Lancs., England, is in the process of expanding its production facilities in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SOLE U.S. REPRESENTATIVE
Straus-Artys Corp.
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HUnter 2-4514

the erection of an addition to its plant.

* * *

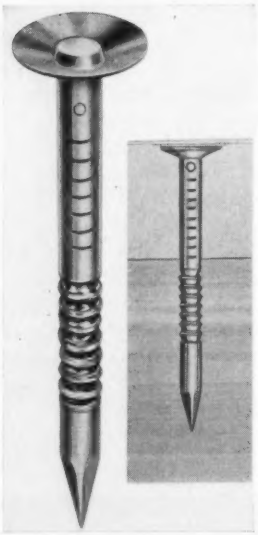
The new building will be 153 feet long by 46 feet wide and will house the new Heavy Fabrication and Erection Shop. It will be equipped with a 25 ton electric traveling crane.

* * *

The company manufactures a variety of machines and equipment, principally for the electric wire and cable industry.

New Dry-Wall Nail

A revolutionary new nail, designed to cut material and labor costs and stop nail popping, is being produced exclusively by **Sheffield Division, Armco Steel Corp.,** Sheffield Sta., Kansas City 25, Mo. The head is conical shaped, with a nub in the center to take the force of the hammer. This protects the thin conical head from distortion and increases the bond of the sealing compound to the steel. The final hammer blow countersinks the head with the rim flush with the wall surface. Annular rings at mid-section of the shank concentrates holding power. This new dry-wall nail will fasten 25% more dry-wall per cwt. than its .098 predecessor. Patent applied for. Write the Sheffield Division for information.



Magnet Rejects Springs Containing Welded Joints

Metallurgists at **National-Standard Co.,** Niles, Mich., have devised a simple method of catching the one spring out of hundreds in a production run that has a weld joint in it. The technique is based on using nonmagnetic spring materials, such as NS-25 alloy.

* * *

A magnetic slug is used in making butt welds in NS-25 superalloy spring wire, which can be drawn into wire in up to 30,000 foot lengths for feeding into automatic spring coiling machines from coils of wire.

* * *

Whenever a welded joint appears in a coiled spring, a magnet pulls it out of the line and rejects it.

* * *

NS-25 alloy springs are used in toaster thermostat controls and clamps for holding microwave parts.

Your answer for producing bunched wire with the smooth concentric qualities of stranded wire . . .

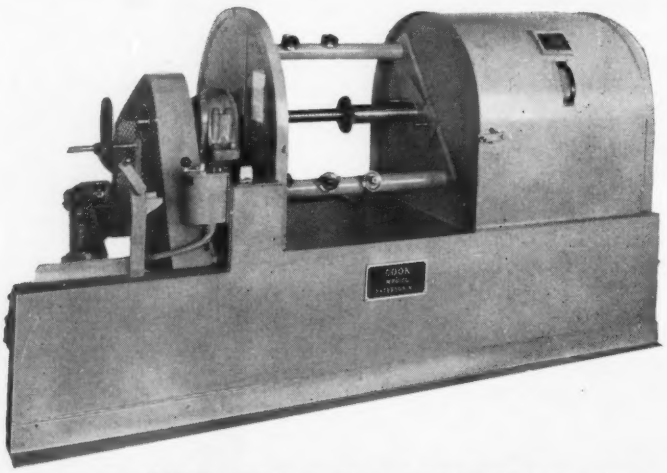
COOK

BUNCHER-STRANDER

makes every foot of wire perfectly uniform

For concentric wires with layers made up of wires in opposite lay directions, or for semi-concentric wire with layers in same direction but with different lays . . . a Cook Buncher-Strander delivers uniform wire at high speed. The secret is the single twist flyer and the Cook patented method of providing differential speeds between flyer and reel. Why delay? Get the complete details today by writing for illustrated brochure.

MODELS AVAILABLE	BH-8	BH-12	BH-16	BH-21	BH-22	BH-24
CAPACITY	40 lbs.	100 lbs.	250 lbs.	350 lbs.	500 lbs.	1000 lbs.



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Compilation of ASTM Standards On Copper and Copper Alloys—B-5

The American Society for Testing Materials announces the availability of the 18th edition of the "Compilation of ASTM Standards on Copper and Copper Alloys-B-5."

* * *

This contains 134 standards of which 37 are new, revised or have had their status changed since the previous edition in 1959. In addition to standards for cast and wrought copper and copper alloys, the book contains some material on non-ferrous materials for electrical conductors, certain selected specifications on non-ferrous metals and alloys for primary forms of copper, zinc, lead, and nickel used in copper-alloy products.

* * *

Typical of the topics covered are copper and copper-alloy plate, sheet, strip, and rolled bar. In addition rods, shapes and die forgings as well as wire, pipe, tubes, and ingots are included. Among the new standards are specifications for: Nickel-Coated Soft or Annealed Copper Wire; Copper-Nickel Alloys in Ingot, Slab or Shot Form; and Copper and Copper-Alloy Seamless Condenser and Heat Exchanger Tubes with Integral Fins.

* * *

Copies of this book may be obtained from ASTM Headquarters, 1916 Race St., Philadelphia 3, Pa., at $9.25 each.

Whitehead Opens New Office and Warehouse

A new sales office and warehouse was opened recently by **Whitehead Metals, Inc.** in Meadows Industrial Park at Woodlawn, near Baltimore, Md. The new building has 30,000 square feet of warehouse area and 4,000 square feet of office space. It permits Whitehead Metals, a subsidiary of **The International Nickel Company**, to increase its service to industry by expanding its inventories of corrosion-resistant metals for prompt delivery in Maryland, the District of Columbia, and Virginia. It will carry a variety of sizes of sheet, rod, pipe, tubing, wire, valves, fastenings, wire mesh, shot and ingots in nickel, high nickel alloys, aluminum, copper, brass and nickel stainless steel. In addition, the Company stocks plastics, and welding and brazing materials.

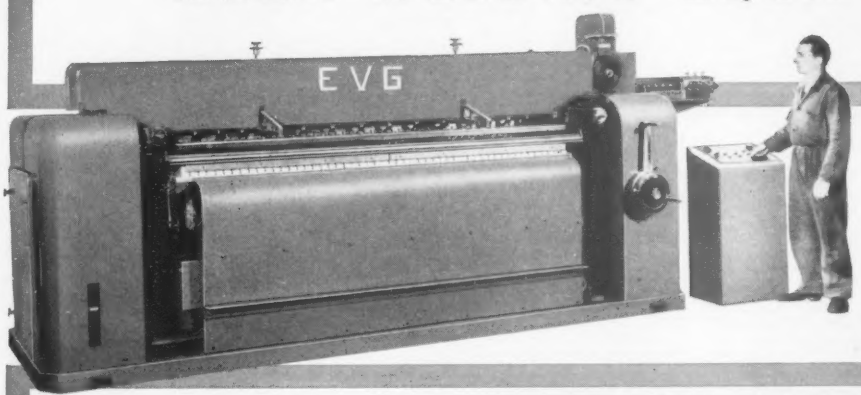
* * *

The Baltimore operation, under the management of **David G. Pettigrew**, is one of eight branch offices operated by Whitehead Metals. **C. D. Grover**, President, and **E. W. Lothman**, Executive Vice-President, are located in the Company's main office in New York, N. Y.

Sunbeam Representative

Sunbeam Equipment Corporation, Meadville, Pa., has appointed **Bishop Engineering Company**, P. O. Box 7031, Tulsa 5, Oklahoma, to represent their line of industrial heat treating furnace equipment in Oklahoma and western Arkansas.

COMPLETE LINE OF FULLY AUTOMATIC MESH WELDING EQUIPMENT



EVG designs and builds the world's most complete line of wire fabric welding machinery—five complete plants covering the entire field of welded mesh. Wire sizes from 7/0 to 25 gauge; all conventional spacings, down to 4 mesh (¼" x ¼"). Special plants can be engineered to customer's specifications.

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COVERS THE WHOLE FIELD OF WELDED WIRE FABRIC

1. **Heavy Duty** model G 6 — designed to handle the heaviest meshes in use, i.e., pipe meshes.
2. **Standard Duty** — handles all constructions specified by engineers for reinforcing road fabrics.
3. **Medium Duty** — a specialized machine for the low-cost production of building mesh and similar fabrics.
4. **Light Wire** machine — a high precision welder, specifically designed for the production of visual type fabrics; fencing, mink batteries, etc.
5. **Fine Wire** machine — an extra high speed, flexible changeover welder. Particularly suited to the production of welded hardware cloth in all gauges and spacings.

Please direct inquiries to: **RICHARD E. KLEINHANS** *U. S.—Canadian Representative*

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Rome Cable Develops New Insulating Material

A new conductor insulation — possessing heat and abrasion resisting qualities hitherto unattainable — has been developed by **Rome Cable Division,** Aluminum Company of America.

* * *

Designated "Rome Poly-X," the new material derives its properties from a unique polyethylene modifying process.

* * *

Having several times the abrasion resistance of conventional polyethylene, this new Alcoa product is particularly suitable for electrical conductor applications requiring a high degree of mechanical durability and toughness.

* * *

Recent tests show the insulation to have virtually unlimited resistance to environmental stress and thermal cracking conditions — compared with the moderate resistance of polyethylene.

Providing insulation rating values up to 600 volts, this versatile new insulation has a damage threshold temperature in excess of 300 degrees C, contrasted with conventional polyethylene, which softens at about 110 degrees C. It has sufficient ductility to permit bending at temperatures as low as -55 degrees C. The performance characteristics are altered by "cross-linking" polyethylene molecular chains.

New Insulated Sleeving

Assembly productivity in wiring electrical and electromechanical equipment is increased with a new insulated sleeving introduced by **Manger Electric Company.** By means of a unique layout and packaging of printed identification code and reference designation sleeves, the new product, called "Idensulation," improves production efficiency by providing work organization to wiring procedures.

* * *

Often referred to as "spaghetti", Idensulation is insulated tubing with designation or identification codes that have been thermo-branded for high clarity. The marked tubing is cut to length and secured to perforated, assembly work cards with adhesive-backed tapes. The coded tubing is arranged in numerical, alphabetical, or sub-assembly order, in accordance with a user's connection list or wire-routing operation sheet, ready for assembly breakdown and assignment to work bench position.

* * *

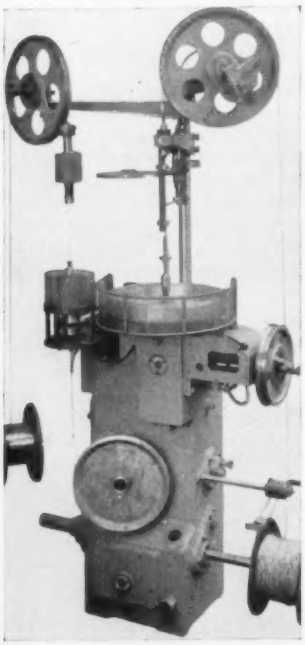
Idensulation is produced in wide range of standard insulating materials, including the "shrink-on" types, and is available in a variety of colors. These materials conform to the military and industrial specifications covering the majority of government and commercial usage requirements.

* * *

Stock items in ASTM sizes 24-1½" imprinted with standard codes are available for delivery within 24 hours. Free samples

FOR TELEPHONE CABLES

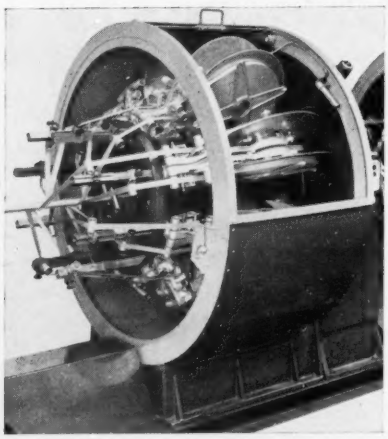
High speed insulating machines



- Paper spindle at 3000 r.p.m.
- String spindle at 8500 r.p.m.
- Paper disc 300 mm
- Traversing take-up reel
- Predeterminating counter
- Automatic stop motion
- 1000 units actually running

FOR HIGH VOLTAGE CABLES

Taping head with 16 papers



- Constant tension braking
- 500 mm paper disc diameter
- Automatic stop motion
- Moveable paper disc for cable diameter variations
- Speed 100 to 350 r.p.m. with speed changer
- Adjustable die

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SALES AGENT FOR NORTH EAST STATES: WEMPUMPS, 1168 South Olden Ave., Trenton 10, N.J. (U.S.A.)

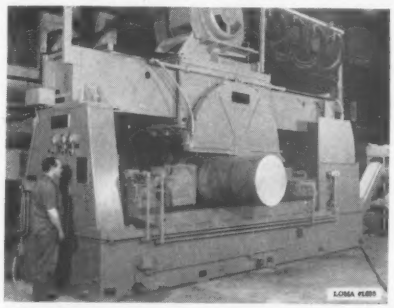
are available on request from Manger Electric Inc., North State St., Stamford, Conn.

Giant Saw Cuts Aluminum Billets

Aluminum alloy billets and slabs up to the largest sizes produced can now be cut faster, with closer length tolerances and with smoother surfaces, thanks to the development of an automated cold sawing installation by **Loma Machine Manufacturing Co., Inc.,** New York 16, N.Y. The new equipment centers around the large, hydraulically operated high-speed circular saw shown in the illustration. Designed to cut billets up to 36 in. diameter and slabs up to 20 in. thick by 80 in. wide, the machine can be equipped with up to 100 in. diameter blades. It is driven by a 200 h.p. two-speed motor to operate at 3000 or 6000 ft. per min. cutting speeds, depending on the alloy being handled.

* * *

An outstanding feature of the new machine is its overhead sliding carriage design, resulting in all essential moving parts of the equipment being located above the



Loma Circular Saw cutting 36" aluminum alloy billet.

saw table. Consequently, the saw carriage with the arbor, gears, belt drive and motor remain entirely free from saw chips and coolant fluid. The entire gear train is supported on adjustable tapered roller bearings assuring vibration-free rotation of the blade.

New Fourdrinier Wire

W. S. Tyler Co., Cleveland, Ohio, manufacturer of Fourdrinier Wire screens for paper making, is using a new composite warp wire developed jointly by them and **Fort Wayne Metals, Inc.,** Fort Wayne, Ind., who produces the wire.

* * *

The new warp wire consists of a phosphor bronze core stranded together with six stainless steel wires. This small cable is then drawn through diamond dies to less than .01" in diameter, annealed, and woven into the Fourdrinier screen.

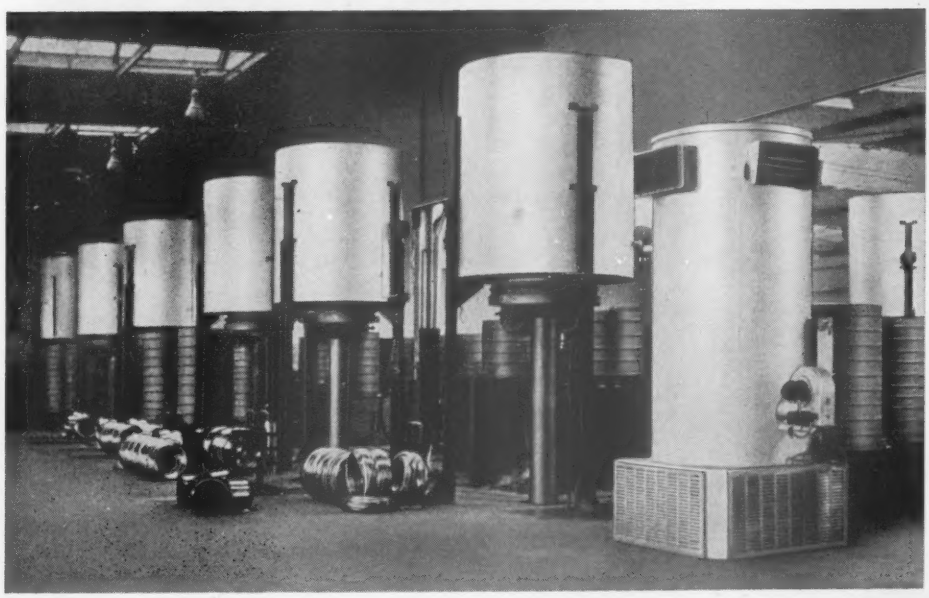
* * *

It is said to have several times the life of standard phosphor bronze warp wires and to have reduced greatly the cost of paper making where it has been used.

Pittsurgh Steel Making "Ardox" Wire

Pittsburgh Steel Company has been licensed by the **Steel Company of Canada** to produce and sell Ardox wire, a new type of spiralled wire for the manufacturers of ornamental iron and

Now also for Stainless and Chrome-Nickel!



FRITZ - VACUUM FURNACES HELP TO SOLVE YOUR ANNEALING PROBLEMS.

(German and Foreign Patents)

★

SOLE REPRESENTATIVE:

PAUL REICHER
Machinery & Equipment
600 Eglinton Ave., East,
Toronto 12, Ont., Canada

WRITE TO: **FRITZ** INDUSTRIAL FURNACES **HAGEN,** P. O. B. 448 (W.-GERMANY)

wire products.

* * *

R. E. Lauterbach, Pittsburgh Steel's vice president—sales, said the new wire product will broaden his company's markets and help develop new formed wire applications.

* * *

Ardox wire, which saves production steps in fabricators' plants, is a development of the **Steel Company of Canada, Ltd.,** which has licensed only two American firms to produce the pre-formed, spiralled wire.

* * *

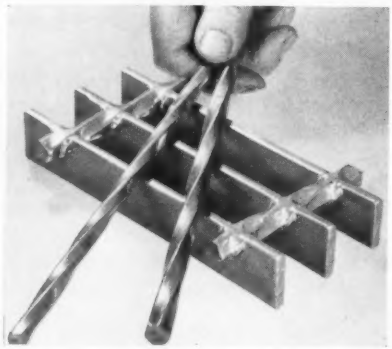
Faster production, fewer fabricating operations and greater strength are among the advantages available to manufacturers. Ardox wire is designed for use in grills, railings, appliances and furniture. It also is available with a patterned design surface for ornamental and appliance use.

* * *

Unlike ordinary shaped wire which must be annealed before delivery and then twisted into shape by the fabricators, Ardox wire is delivered ready for use. Its shape is achieved by cold drawing at the mill. Twisting equipment is eliminated. Cold drawn wire retains its basic metallurgical structure and provides greater uniformity of strength.

* * *

Pittsburgh Steel's Ardox wire, made from low carbon steel or to the customer analysis, is available in coils, or in straight



lengths from 2 feet to 20 feet, and in a diameter range from .072 inches to .750 inches. Write to Pittsburgh Steel Company, P. O. Box 118, Pittsburgh 30, Pa.

Wire Testing by Ultrasonics

An article in the September, 1960, issue of **Wire and Wire Products** of the above title described the achievement of a successful method of detecting flaws in wire. Hitherto, this had not been possible.

* * *

The procedure has been found effective in indicating the presence of foreign inclusions, cracks, etc., with great sensitivity at speeds up to approximately 200 feet per minute.

* * *

Marathon Specialty Steels, Inc., 375 Park Ave., New York 22, N.Y., is pleased to announce that it has concluded arrangements to represent in this country the Dr. Lehfeldt Co., G.m.b.H., Heppenheim, West Germany, developers and manufacturers of this ultrasonic testing equipment for wire.

Sjogren SPOOLER

This machine is especially designed for wire mill use and incorporates many outstanding features adapted to present day high speed production.

SPEED — When placed directly behind wire drawing machine the Sjogren Spooler is capable of spooling at 1800 fpm.

CAPACITY — 100 pound maximum.

TRAVERSE — Hydraulic traverse is infinitely adjustable from zero to 5/8" per rpm of spool.

LOADING — Loading of spool is air-actuated.

TENSION — Louis-Allis eddy current clutch type motor with potentiometer for variable tension.

STARTING — Forced acceleration circuit prevents slack wire during wire drawing machine acceleration.

BRAKING — Goodyear airplane disc type brakes.

USED BY WIRE MEN WHO WANT THE BEST!

Sjogren TOOL & MACHINE CO., INC.

14 Sword St.
AUBURN, MASS.

WIRE PULLERS • WEDGE GRIPS • JAWS FOR ALL MAKES OF PULLERS AND TESTING MACHINES • GAGE ROLLERS • SWAGING HAMMERS • POINTING DIES • WIRE SPOOLERS

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50¢ for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,986,805, METHOD OF MAKING WIRE-WOUND RESISTANCE ELEMENTS, patented July 6, 1961 by Joseph L. Jonke, Bethpage, N. Y., assignor to Fairchild Camera and Instrument Corp., a corporation of Delaware.

Starting with a card having one straight edge parallel to the longitudinal axis of the card and at least one edge portion tapered with respect to the longitudinal axis and opposite the straight edge, the winding steps comprise supporting the card in such manner that its longitudinal axis is offset an amount sufficient to form an angle with a rotational axis equal to one-half the angle of the tapered edge, rotating the card in its offset position about the rotational axis, and winding turns of the resistance wire around the card during rotation of the card, the wire being wound on the card in a direction normal to the rotational axis.

* * *

No. 2,988,137, SPRING DECK FOR FURNITURE, patented June 13, 1961 by William F. Richardson, Carthage, Mo., assignor to Flex-O-Lators, Inc., Carthage, Mo., a corporation of Missouri.

A spring deck for furniture is disclosed, comprising a frame, a number of arches extending in generally parallel relation across the frame and secured at their respective ends to the frame, each of the arches comprising a series of wire spring links each extending longitudinally of the arch and being resiliently flexible in a direction transverse to the arch, the links comprising each arch being interconnected with successive links overlapping each other in a direction longitudinal to the arch, the respective extreme end portions of each link being disposed above and bearing downwardly against the next adjacent link in spaced relation from the end thereof.

* * *

No. 2,988,291, STATOR COIL WINDING MACHINE, patented June 13, 1961 by Paul B. Greene, Albert B. Mewhinney, and Francis E. Wirtz, Dayton, Ohio, assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware.

A winding head is provided and arranged to be movable into operative positions with a number of slots in the stator, through a cantilever support including driving means remaining connected to a chain-moved wire-guiding eyelet even during indexing to various parts of slots. Eighteen claims.

* * *

No. 2,988,292, METHOD AND APPARATUS FOR SPOOLING WIRE, patented June 13, 1961 by George L. Bliss, Cleveland, Ohio, assignor to United States Steel Corporation, a corporation of New Jersey.

The method and apparatus disclosed in this patent is described as improvements on those included in the inventor's prior patent 2,845,229 of June 3, 1954, and it is stated better control of the traversing means during the actual reversal steps is had with the presently-described apparatus.

* * *

No. 2,988,467, PROCESS FOR THE MANUFACTURE OF HIGH VOLTAGE ELECTRIC CABLE WITH MULTI-PART INSULATION, patented June 13, 1961 by Henri Thevenon, Lyon, France, assignor to Compagnie Generale d'Electricite, Paris, France, a corporation of France.

According to the invention, there is provided a process in which the insulation for the cable is divided into a number of concentric fractions, positioned in consecutive operations, wherein the step of positioning one fraction in one pass is terminated by placing at least one semiconductive layer on the outer surface of the fraction and subsequent fractions in the next pass is commenced by placing a further semiconductive layer in the first-mentioned layer.

* * *

No. 2,988,804, METHOD OF WINDING ELECTRIC COILS, patented June 20, 1961 by Raymond W. Tibbetts, Camden, Maine, assignor to Tibbetts Industries, Inc., Camden, Maine, a corporation of Maine.

(ILLUSTRATED)
42" x 20" x 21"—(4000# cap.)

Heavy Duty

BREAK-DOWN REELS

1000#
2000#
4000#
} capacities

Rugged Design including patented DURA-CURL rim, and many other features necessary to provide the *Strength* and *Durability* needed for continued successful performance.

Also complete line of sizes of Modern High Speed Wire Drawing NO-CREV Spools and Reels for both fine and intermediate size wire.

Mossberg PRESSED STEEL Corporation
"Division of Wanskuck Co."
18 WEST ST., ATTLEBORO, MASS., U.S.A.

Telephone
CAstle 2-0847

#103

A bobbin is formed of core material having a groove extending around its periphery intermediate its ends, the core material being dissolvable in a solvent, the wire is wound in the groove until it is partially filled except for a filling opening, covering material is placed to close the groove (this material also being soluble in the solvent) the groove is then filled through the opening with insulation material to set in a rigid structure insoluble in the solvent, whereupon the closed bobbin is immersed in the solvent to remove the core and covering material.

* * *

No. 2,989,172, WIRE BOX ASSEMBLY, patented June 20, 1961 by Emil Stoll, Racine, Wis., assignor to J. I. Case Company, Racine, Wis., a corporation of Wisconsin.

A baler is patented having a number of wire box assemblies secured thereto and adapted to contain baler wire.

* * *

No. 2,989,190, WIRE PACKAGE RACKS WITH ADJUSTABLE DIVIDERS, patented June 20, 1961 by Edmund J. Buzicky, St. Paul, Minn., assignor to Whirlpool Corporation, a corporation of Delaware.

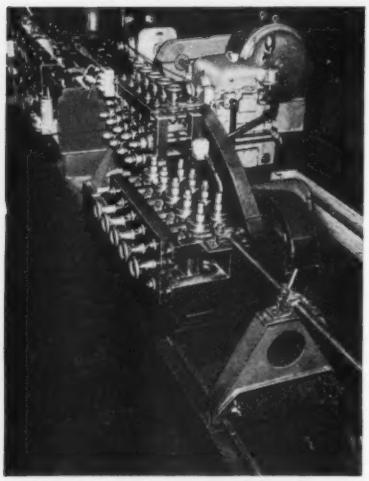
Thirteen claims in this patent for a stiff wire storage basket for freezers and the like.

* * *

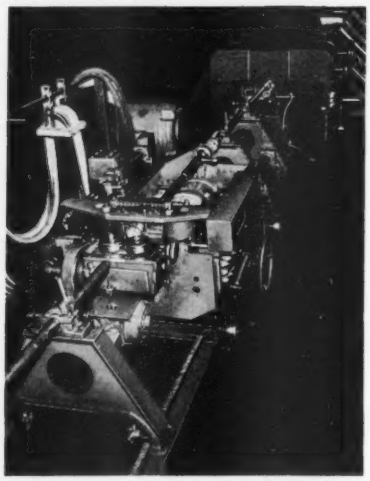
No. 2,989,254, APPARATUS FOR WINDING WIRE ON EXTREMELY SMALL ANNULAR CORES, patented June 20, 1961 by Alfred Polzlbauer, Zurich, Switzerland, assignor to Micafil A.-G., Zurich, Switzerland, a joint-stock company.

LOMATIC

COMBINED DRAWING STRAIGHTENING CUTOFF AND POLISHING MACHINE



Payoff - Drawbench - Straightener



Flying Shear - Polisher - Discharge

Now available in two standard sizes, the revolutionary LOMATIC machines handle ferrous and non-ferrous rods and tubes at speeds up to 200 ft. per min. and with drawing capacities up to 16,000 lb. Compared to conventional separate rod drawing, straightening, polishing and cutting-to-length operations, the LOMA single-operation fully automatic machine offers the following major advantages:

- **Greater output rate — continuous operation at high speed**
- **Reduced labor cost — only one operator required**
- **Improved straightness — stock is straightened in two planes**
- **Perfect concentricity — obtained by straight-line drawing action**
- **Higher surface finish — due to two-stage polishing unit**

The complete line comprises an uncoiler, a pre-straightener, a drawbench, a roller straightener, a flying cutoff, a polishing machine and a discharge table. All components required for the complete sequence of processing operations are interlocked mechanically and electrically into one integrated and synchronized line which is controlled by only one operator.

Our standard line of equipment includes:

- **Casting Machines and Molds**
- **Saws and Cut-off Machinery**
- **Hot and Cold Rolling Mills**
- **Rod and Tube Draw Benches**
- **Roller and Stretcher Levellers**
- **Air and Hydraulic Tube Testers**

LOMA
MACHINE MFG. CO., INC.
114 East 32nd Street
New York 16, N. Y.

The apparatus includes an annular tube with a radial cutout portion into which is transversely inserted an annular workpiece, the tube being provided with a wire-pulling runner member which is pneumatically driven in a circular path within the tube to wind the wire upon the workpiece.

* * *

No. 2,990,133, ONE PIECE MOLDED SPOOL, patented June 27, 1961 by George G. Tucker, Jr., Auburn, Ind., assignor to American Pulley Co., Garrett, Ind., a corporation of Pennsylvania.

A molded hardened plastic spool is disclosed which is stated to be adapted to contain wire wound thereon but which may be manufactured so cheaply that the spool may be discarded after the wire is removed.

* * *

No. 2,990,134, APPARATUS FOR STORING AND GUIDING SUBMARINE CABLE, patented June 27, 1961 by Oswald Robert Bates, North Harrow, and Ronald Joseph Ashby, Orpington, England, assignors to Johnson & Phillips, Limited, and Her Majesty's Postmaster General, both of London, England.

Cable having repeaters at intervals therein may be stored on this apparatus having a hollow cone of a size to contain a number of repeaters and to have many miles of submarine cable coiled around the outside thereof, the cone having its upper end open and a slot in the wall of the cone opening at the open end of the cone, and an inclined platform within the cone having an abutment at the lower end whereby the repeaters are supported in inclining layers and the cable is coiled around the exterior of the cone with portions of the cable adjoining the ends of the repeaters within the cone passing through the slot.

* * *

No. 2,990,135, ADJUSTABLE PAY-OFF REEL, patented June 27, 1961 by Homer J. Croteau, Oxford, and Walfred A. Wallsten, Shrewsbury, Mass., assignors to United States Steel Corporation, a corporation of New Jersey.

The reel rotates on a vertical axis and includes a number of spaced-apart two-legged members with one leg of each pivotally supported on a horizontal portion of the reel, with the other legs substantially paralleling the vertical axis but which may be moved out of such parallelism.

* * *

No. 2,990,136, AUTOMATIC SPOOLING OR REELING DEVICE, patented June 27, 1961 by Alvin H. Wilkinson, Talala, Okla., assignor to Cabot Corporation, Boston, Mass., a corporation of Delaware.

This device comprises a normally stationary but adjustable frame including transverse supporting members, a fluid pressure cylinder pivotally connected at one end to one of the members, a cartridge movable on another of the members and connected to the piston and rod of the cylinder, means for leading a cable through the carriage, and sensing means on the carriage having fluid pressure valved controlling connections with the cylinder whereby movement of the carriage is effected in response to valve operating action of the sensing means.

Moves Michigan Office

The Silicone Products Department of General Electric Company has moved its Michigan

sales office location from Detroit to Oak Park, Mich., at 21590 Greenfield Road. According to sales manager **K. J. Morray**, the move to new larger quarters is designed to provide improved service to customers in the area.

* * *

The Silicone Products Department manufactures silicone rubber compounds, resins, fluids, emulsions and specialty products as well as silicone intermediate chemicals. These materials are used as electrical insulation, polish additives, textile finishes, paint additives and in numerous other industrial applications. The manufacturing, research and marketing facilities for General Electric silicones are in Waterford, N. Y.

New Plant Facilities for Thermoplastic Processes

With the addition of 6,000 sq. ft. of new plant facilities, **Thermoplastic Processes, Inc.** has increased its production of custom extrusions and are supplementing existing Vinyl tubing (Excelon) line with a stock line of Acrylic and Butyrate tubings.

* * *

Thermoplastic Processes, Inc. and **Thermoplastic Equipment Corporation** are located on Valley Rd. in suburban Stirling, N. J. Thermoplastic Processes specializes in rigid plastic profiles, flexible tubing and sheeting for vacuum forming and other purposes, as well as custom extruding of most Thermoplastic materials.

* * *

Thermoplastic Equipment manufactures a line of Vertical Extruders used for the production of multicolor profiles or the identification of electrical conductors. It is also the North American representative for the "Helicolor" machine, a complete unit for the insulation of fine wires with three different colors in helical stripes. The additional plant space, and the accompanying modern facilities and manufacturing techniques, put both companies in a leading position as suppliers of Thermoplastic extrusions and TEC Extruders.

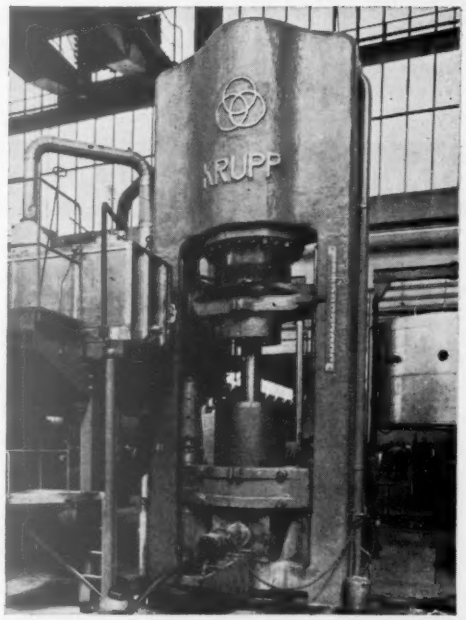
New Data Sheets on Geon Compounds

The B. F. Goodrich Chemical Co., 3135 Euclid Ave., Cleveland 15, Ohio, has reviewed and brought up-to-date all of its Geon wire and cable compound data sheets.

* * *

These include new data, new suggested applications and a number of new compounds. Copies of these data sheets for your files may be obtained from the company upon application.

KRUPP



Aluminum or lead-sheathing press

our manufacturing program includes:

HYDRAULIC PRESSES FOR THE CABLE INDUSTRY:

Cable sheathing presses for lead and aluminum. Special presses for lead and tin. Other hydraulic equipment for straightening and stretching.

Extrusion presses also supplied

Accumulator vessels and pump stations for water and oil

Hydraulic controls, fully accessorized

Lead melting and aluminum ingot induction heating plants

Lead- and aluminum-sheath stripping machines
Aluminum sheath corrugators

150 YEARS
KRUPP
1811-1961

FRIED. KRUPP MASCHINEN- UND STAHLBAU RHEINHAUSEN, GERMANY

In the Continental US contact: KRUPP INTERNATIONAL INC., 375 Park Ave., New York 22, N.Y.

New Polyethylene Cellular Extrusion Compound

A new polyethylene compound specifically designed for thin-walled cellular primary insulation was a feature of the **Union Carbide Plastics Company's** exhibit at the SPI Show in New York, June 5-9.

* * *

The new polymer, Bakelite DGDA-2580, is tougher than previously available plastics for cellular extrusion. At 30 per cent cellular composition, the new polyethylene also has higher tensile strength than solid polyethylene insulation, while maintaining the same excellent low-temperature flexibility.

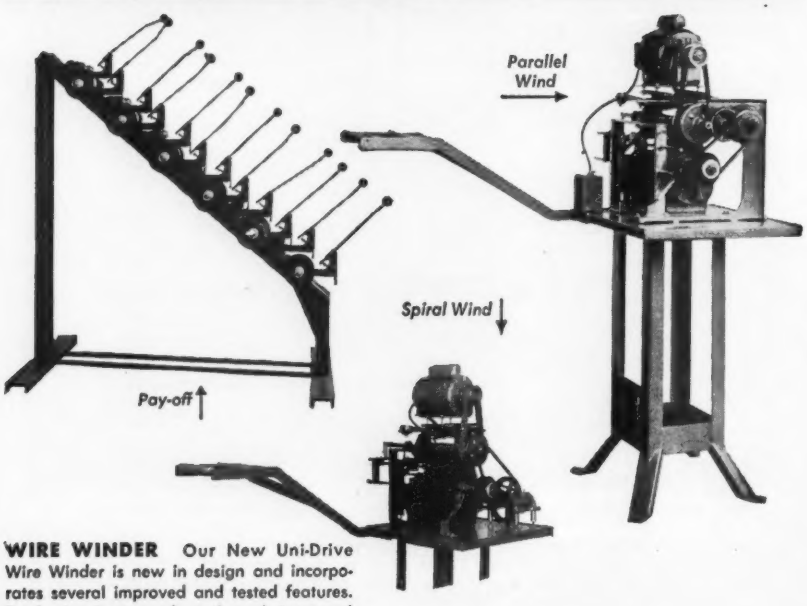
* * *

A uniform dispersion of spherical gas cells within the extruded materials makes possible a relatively low dielectric constant, thus permitting telephone singles insulation with reduced wall thicknesses. Since this will also allow a reduction in size and weight of the overall cable, less outer jacketing is required and more cable can be wound on a reel. As a bonus, shipping costs are thus lowered, and multiconductor cables will now be easier to handle because of their smaller size and lighter weight.

* * *

The properties of the new cellular polyethylene also recommend it as insulation for high-frequency applications such as video pairs, community coaxial cable and antenna lead-in, and as bedding for insulated members to fill out multi-conductor cables. Presently-used fibrous materials, such as cotton or jute, pick up moisture, are poor dielectrics, and tend to degrade overall performance of the cable.

STANDARD UNI-DRIVE WIRE WINDER



WIRE WINDER Our New Uni-Drive Wire Winder is new in design and incorporates several improved and tested features. Production is stepped up through increased speed. It produces smooth, even and accurately wound spools of wire in single or multiple ends. All strands parallel — no over or under-winding. Can also be furnished with a slight spiral pattern for winding exceedingly fine wire. Automatic Stop Motion controls each strand. Traverse adjustable from 1¾" to 5½" between spool heads without changing cam. Designed especially for winding wire to be braided and shielded for electrical conductors.

Various types of supply packages that may be wound on Standard Uni-Drive Wire Winder.

PAY-OFF Our Pay-off Attachment consists of a heavy fabricated frame on which Pay-off spools are mounted to cover desired number of ends to be wound. Equipped with spindles, running on self-aligning ball bearings, with size of spindles and adapters to accommodate customers' pay-off spool. Compensating Attachment to control the tension of each individual strand of wire, applying the same tension when spool is full as when empty. Can also be adapted for use with bunching machines.

STANDARD MILL SUPPLY COMPANY
31 ESTEN AVENUE PAWTUCKET, R. I., U. S. A.

U.S.I. Forecast Polyethylene Growth

American-produced conventional polyethylene will be serving a 1.6 billion-pound market by 1965, according to **Vincent D. McCarthy**, Director of Plastics Sales of **U.S. Industrial Chemicals Company**, a Division of National Distillers and Chemical Corporation.

* * *

Mr. McCarthy says that from all present indications, the domestic market will break down this way: Film and sheet 610 million pounds; substrate coating, 250 million; injection molding, 235 million; wire and cable coating, 170 million; export, 150 million; miscellaneous, 85 million; extruded pipe, 70 million; and blow molding 60 million, for a total of 1,620,000,000 pounds.

* * *

"This represents an average growth rate of 7% per year between 1961 and 1965 as contrasted to the 25% growth rate that prevailed in the late 1950's — a clear indication that the industry has matured, although there is still reasonable growth ahead," Mr. McCarthy stated. "However, rated production capacity for conventional polyethylene today is close to 1.7 billion pounds, or already large enough to handle the 1965 projected demand."

* * *

Increasing reliance on effectively-coated distribution-system wire and cable by electric utilities —

and the expansion of such utilities to meet the power needs of a growing America — make it likely that some 170 million pounds of polyethylene will be used to coat wire and cable in 1965.

Add-Subtract Digital Process Controllers

Dynapar Corporation, electronic subsidiary of **The Louis Allis Co.,** has announced the introduction of a complete line of Add-Subtract Digital Process Controllers for automation control.

* * *

Add-Subtract Controllers provide direct reading numerical indication of bi-directional counting or measuring operations and actuate machine control functions automatically when preset numbers are reached. The controller adds or subtracts when pulses from a transducer or sensing device are applied to the controller to provide direct reading numerical display of virtually any "up or down" counting or measuring operations. When successive preset numbers are reached, control functions are preformed. Preset numbers may be set up by panel knobs, or remotely by punched tape, magnetic tape or punched cards.

* * *

These controllers are available for a wide range of production and process equipment, including such typical applications as cutting-to-length, positioning, balancing, drilling and coil-winding.

* * *

Write for Bulletin 202, The Louis Allis Co., Dept. P, 427 E. Stewart St., Milwaukee 1, Wis.

New Fenn Turks Head Catalog

The Fenn Manufacturing Company, Newington, Conn., manufacturers of metal forming machinery, has published a new comprehensive catalog on Turks Heads, adjustable draw plates, that are widely used for forming accurate squares and rectangles directly from round wire and finishing special shapes or forming edge contours on flat metal ribbons.

* * *

The catalog contains detailed information on uses and applications, size control, surface finish, basic types, pull-through power sources, wire shaping mills, and case histories on actual installations. Copies may be obtained by writing to The Fenn Manufacturing Company, Fenn Road, Newington, Conn.

Catalog on Wheelabrator Super Tumblast

A completely revised 28-page catalog describing the complete line of the improved Wheelabrator Super Tumblast, batch-type airless abrasive blast cleaning machines, has been issued by **Wheelabrator Corporation,** Mishawaka, Indiana.

* * *

Six sizes of this high efficiency blast machine, ranging in operating load capacity from seven cubic foot to 100 cubic foot, are described in the new profusely illustrated catalog. Extensive use of photographs, cross section and exploded views, and drawings is made in explaining construction features and operating sequences.

* * *

For a copy of the new litera-

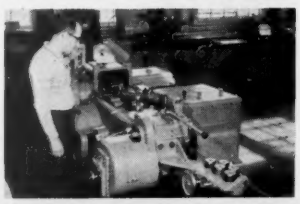
For THE ABBOTT BALL COMPANY...

THESE GREENBAT HEADERS

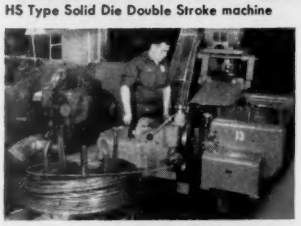
HS Type Solid Die Single Stroke machines

...HAVE INCREASED PRODUCTION 200%

...AND REDUCED MAINTENANCE BY 50%



HS Type Solid Die Double Stroke machine



No. 3 (⅜") Solid Die Single Stroke machine

The world's leading producer of carbon steel bearing balls and shapes, Abbott has moved positively to ensure this leadership by installing versatile, high speed Greenbat heading machinery. In addition to the outstanding advantages cited above, Abbott has broadened its manufacturing capability considerably.

Available through the "Greenbat Sales Division" of Unitech Products, Inc., the famous Greenwood & Batley Ltd. line includes single, double, and triple stroke machines, head trimmers, friction presses, and thread rollers. Every machine is completely motorized and has a wire straightening feature as standard equipment. Other features include durability and speed comparable to any standard domestic machine, ease of tool setting and complete tool interchangeability with machines of other makes. They are supplied with American threads if desired.

You too can take advantage of Greenbat's low investment requirement, economy of operation, and outstanding performance efficiency. Investigate now by writing for complete data on your specific needs.

GREENBAT SALES DIVISION

UNITECH Products Inc.

10 RAILROAD AVENUE • HARTFORD, CONN.

ture, Catalog No. 162-D, write to Wheelabrator Corporation, 1184 S. Byrkit Street, Mishawaka, Ind.

Improved Compound Introduced By Blane

An improved No. 2100 compound to cover the complete range of military specifications MILW 5086A and MILW 16878C, type B,C,D, has been announced by **The Blane Corporation,** manufacturers of vinyl and polyethylene compounds and color concentrates.

* * *

The result of continuous research and testing, the improved No. 2100 compound is designed primarily as an insulation in applications requiring a temperature range of 105° C to -55°C. Blane's improved No. 2100 combines excellent high temperature properties with superior low temperature characteristics required for thin wall and heavy wall insulations used in missile, cable, aircraft and other government specifications.

* * *

Further information on Compound No. 2100 may be obtained by writing direct to the Blane Corporation, Canton, Mass.

NEMA Standards Publications

The following new and revised publications have just been issued. Copies are available at the prices indicated from the **National Electrical Manufacturers Association,** 155 East 44th St., New York 17, N.Y. (Minimum Order $1.00)

AS 1-1961 Definitions for Industrial Automatic Systems
Definitions applying to industrial automatic feedback control systems are contained in this book.
(35 cents per copy)

HE 2-1961 Electric Comfort Heating Equipment
Contains the latest definitions, ratings, markings, methods of test, performance, safety and durability of electric space heating equipment of the types principally used in residences, such as baseboard heaters, wall heaters and heating cable.
(35 cents per copy)

HU 1-1961 Industrial Heating Units and Devices
Covers cartridge, tubular, strip, immersion and tubular-type water-immersion heaters.
(35 cents per copy)

MW 2-1961 Single and Heavy Polyurethane-coated Round Copper Magnet Wire
Information is given concerning dimensions, coating, packaging, testing and retesting.
(35 cents per copy)

TR 2-1960 (EEI 60-54) EEI-NEMA Standards for Distribution Transformers, Overhead Type—Seventh Report
The Seventh Report contains design standards for certain mechanical and electrical features of overhead-type single- and three-phase distribution transformers rated 500 kva and smaller, high voltage 67000 volts and below, low voltage 15000 volts and below. $1.25 per copy)

WC 21-1961 Nonreturnable Reels for Wires and Cables
Applies to reels generally intended for shipping rubber- and thermoplastic-insulated wires and cables and not intended to be returned to the supplier when the contents have been removed. (30 cents per copy)

Cable System Markers on Assembly Coded Cards

A new system of identifying and coding control system interconnection cables is available from **Manger Electric Co.** of Stamford, Conn. The new product, called Identitape, reduces system installation time and eliminates guesswork from the costly task of cable

the latest HIGH SPEED
TUBULAR STRANDING MACHINE
from HANSON & EDWARDS . . .

. . . for the cable and wire rope industries.

* External wire guides increase efficiency—reduce "down-time"—provide quick, easy threading.
* Overall dimensions reduced—increased speed.
* Electro-mechanical or electrically operated air brakes to choice.
* Rotor runs in large split roller bearings.
* Direct gear-driven capstan gives positive lays.

19-12½ bobbin machine, one of the new models now in production. The capstan unit, with cantilever mounted haul-off sheaves, is a complete separate unit coupled by shaft and flexible coupling to the main machine.

HANSON & EDWARDS LTD
WARRINGTON ENGLAND
SALES ORGANISATION:
JAMES DAY (MACHINERY) LTD 28 MADDOX STREET LONDON W1

U.S. AGENTS:
THE EDMANDS COMPANY 860 WELLINGTON AVENUE CRANSTON 10, R.I.

P5078

and connector identification at the time of assembly.

* * *

Beginning with a customer's system diagram or with a cable routing list, Manger Electric provides work-oriented cards of coded identification and reference designation pressure-sensitive tapes, keyed to an interconnection drawing. The cards of specifically-marked individual tapes also can be arranged to follow specified equipment installation procedures based on order of assembly. The markers are removed easily from the assembly cards which are designed to withstand work-bench and field handling.

* * *

Identitapes are available in a range of standard materials and colors, as well as "shrink-on" type. Nearly all industrial and military specifications are met, including MIL-I-7798 and AMS 3652 (Teflon). Stock items imprinted on standard materials are available in two days. Free literature and sample of Identitape upon request to Manger Electric Co., Inc., Miller St., Stamford, Conn.

Cable Firm Buys Sealant Manufacturer

Airborne Controls, Inc., Sun Valley, California, manufacturers and designers of light weight airborne harnesses and electrical wiring and cable for ground support systems, has announced the acquisition of **Electronic Sealing Inc.,** Los Angeles.

* * *

Vaughn R. Chadbourne, vice-president and general manager of Airborne Controls, stated that the purchase offered ABC the added advantage of new sealant techniques gained through the merger, giving greater assurance of maintaining ABC's record of never having missed a delivery date.

W. E. Adding to Point Breeze Works

Construction has been started on a 150,000 square foot addition to **Western Electric Company's** plant in Baltimore, Md., to house production facilities for some special types of cable for long distance service.

* * *

Equipment to be installed will include stranding machines and plastic extruders for cable coating. The new wing, that will cost approximately $4,000,000, is expected to be completed in the Spring of 1962.

Kupfrian's Name Changed

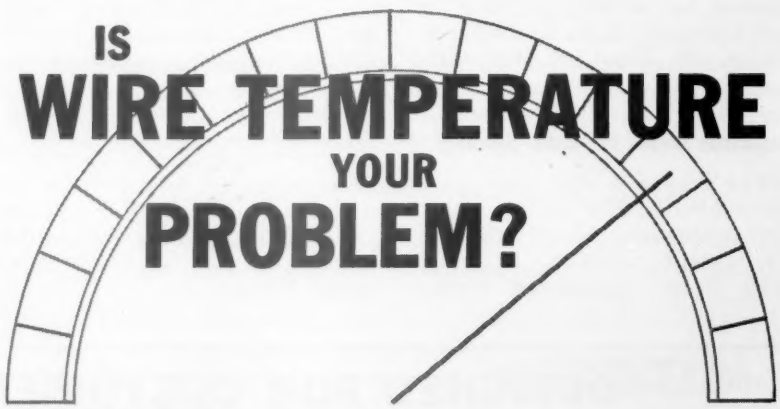
Kupfrian Mfg. Co., Binghamton, N. Y., manufacturers of flexible shafts, couplings, wire shieldings, electrical harnesses and other products, has been consolidated with **Robinson Technical Products, Inc.,** Teterboro, N. J., and hereafter will be known as **Kupfrian Manufacturing Div., Robinson Technical Products, Inc.**

Case Study Portfolio on Bars

La Salle Steel Company has introduced the second in a series of case study portfolios on "Fatigue-Proof" Steel Bars.

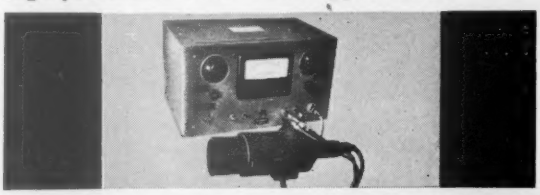
* * *

The latest portfolio deals with the effect of "Fatigue-Proof" on end costs in typical parts applications. It reveals dollar-and-cents



PYROTEL non-contacting **pyrometer will solve it!**

In every wire manufacturing process where heat is a factor, you can read temperatures "on the fly" (at speeds up to 6,000 ft./min.) with non-contacting Pyrotel infrared radiation pyrometer.



Whether bare wire, or rod, or coated wire, Pyrotel operates with equal accuracy, can be used to *control* heat for improved quality, lower costs and increased efficiency. Can be used in preheating, patenting, drawing, insulating, annealing, stress relieving, spring tempering, tinning, enameling, hot dipping or any other process involving heating or cooling.

Pyrotel can be used with the same accurate results whether a few inches or many feet away from the object.

Write for full information.

MASON

MASON INSTRUMENT CO., INC.
22P VALLEY PLACE. MAMARONECK. N. Y..

savings in individual studies on: (1) An adapter for a coil winding machine; (2) A diesel pump fitting; (3) A foundry flask guide pin (4) An oil pump distributor shaft; (5) A power steering pedestal shaft; (6) A motorcycle axle shaft; (7) A generator armature shaft; (8) A transmission shifter post; (9) An outboard motor tilt pin; (10) A ball stud for a steering arm.

* * *

This new portfolio should be of interest to production, design and plant maintenance engineers, or to anyone who is involved in the selection and purchase of material for parts. A free copy may be obtained by writing to La Salle Steel Company, P. O. Box 6800-A, Chicago 80, Ill. Ask for Case Study Portfolio No. 2.

Expands Line of Coil Springs

More than 800 new sizes have been added to the line of precision compression and extension coil springs available as stock items from **Associated Spring Corporation,** Bristol, Conn.

* * *

Totalling more than 1500 sizes with the added units, the springs have been designated Standard Precision Engineered Coil (SPEC) springs. They are normally available for shipment within 24 hours of receipt of order.

* * *

With a new SPEC spring catalog, users can rapidly match required O. D., wire size, length, and other specifications with complete listings. Each spring size is listed by individual order number in sections conveniently headed by O. D. size. With spring items available from stock, users enjoy fast, economical service that is especially valuable for small-quantity orders, experimental work, and replacement needs.

* * *

For more information on the expanded line of stock SPEC springs and a complete price list, write: Associated Spring Corporation, Bristol, Conn.

Catalog of Shawinigan Resins' Line

A new 12-page booklet describing the physical properties and suggested uses of the firm's full product line has been published by **Shawinigan Resins Corporation.**

* * *

The new Product Reference File, which is an expansion of a shorter work, presents data on Formvar, polyvinyl formal, Butvar, polyvinyl butyral, Gelvatol, polyvinyl alcohol, and Gelva, polyvinyl acetate, resins, emulsions and spray-dried powders.

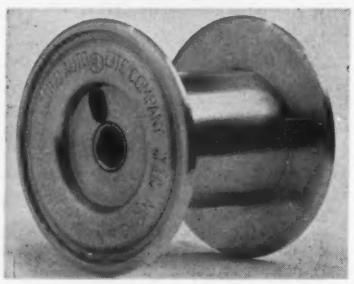
* * *

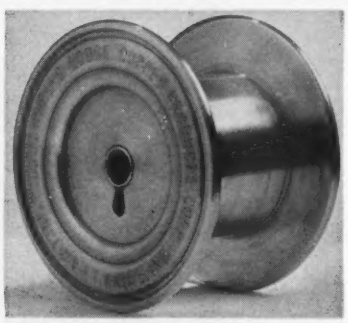
Copies of the booklet are available on request from Shawinigan Resins Corporation, Department DP, Springfield 1, Mass.

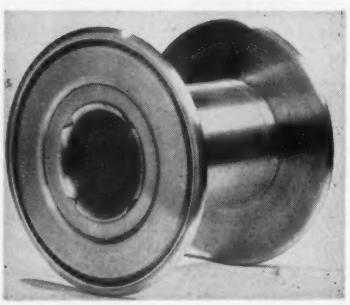
THE BUYERS' GUIDE will help you locate sources of supply.

DESIGNED FOR CUSTOMER APPEAL:

HUBBARD ALUMINUM SPOOLS







NEW FEATURES

1. STRONGER ALUMINUM HEAD — NO WEIGHT INCREASE
2. WELDED CONSTRUCTION — NO OPENING AT HEAD AND BARREL
3. SMOOTH SURFACES — NO SNAGS, REDUCES WIRE SCRAP LOSS
4. UNIFORM TARE WEIGHT — IDEAL FOR BULK WEIGHING

HUBBARD SPOOL DIVISION

Van Norman Industries Inc.

TELEPHONE FL 7-5141 GARRETT, INDIANA

Transport Organisation—The Economic Aspects in Relation to the Light Steel Industry

(*Continued from page* 1033)

goods have left the lorry or railway wagon the cost to oneself and one's competitors are identical. The dues payable to the Dock Authority are fixed, and the freight rates of the Conference Lines are the same. Therefore it is up to the individual manufacturer to cut the cost between factory and port as much as possible. In view of the wide range of weights which are now being shipped it is as well to obtain a flat rate to cover all export traffic so that the lowest possible haulage rate may be obtained. However, a factor which is more common to export traffic is the time that lorries can be held up at the dock awaiting their turn to be unloaded on to the quay at the ship side. In all fairness to the contractor, this should be taken into consideration. In fact, if the delay is too long, the driver may have exceeded the hours allowed by law, and may have to have a relief driver sent out to bring the lorry back, or to wait unloading.

* * *

Although warehousing may not actually be regarded as a transport cost, it may be that goods will have to be warehoused "in transit", due to delay of a ship in a foreign port or to a dock strike, which, alas, can mean the loss of profit on export goods which have been produced. Insurance is another item which is included in our transport costs, as it covers the goods from warehouse to warehouse and up to 60 days after discharge, under the Institute Clauses. Even for F.O.B. shipments we find it useful to insure from warehouse to ship in respect of expensive commodities such as copper. It is particularly important that instructions for F.O.B. shipments should be requested as soon as possible, in order to avoid warehousing.

* * *

Each port has its own peculiarities, and it is as well to know what cost is involved at each. For instance, at Liverpool the charges would be carriage to the port, plus insurance, dues, freight, agency, permit and Bill of Lading, and sometimes preparation and presentation of consular invoice. In London, the items will be somewhat similar but with the addition of wharfage charges and/or rail haulage. If goods are sent by rail at a c/d (collected and delivered) rate, this will include wharfage, but if the goods are consigned to "station" only, a debit for railway haulage will also be raised. If shipped from Manchester it is possible to obtain a railway rate for export traffic which will include the Manchester Ship Canal tolls.

* * *

The cost of carriage to the port will vary according to the source of manufacture, therefore it must be obvious that the nearest port should be used, wherever possible.

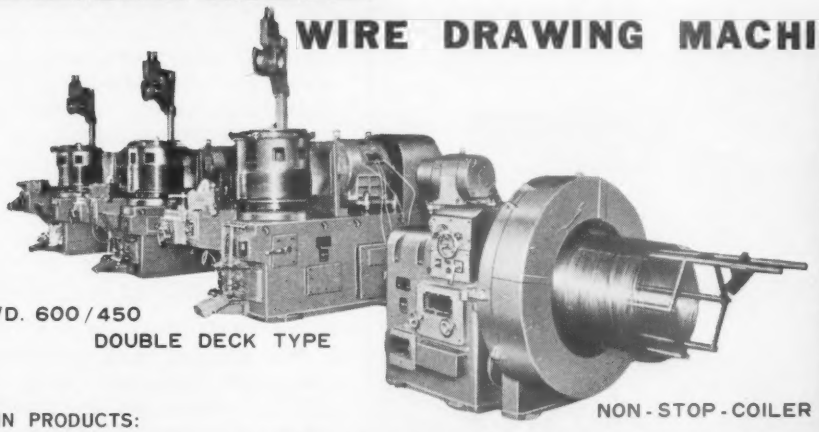
Air Transport

In this "jet propelled" age, the facilities offered by air transport

Tanisaka

Continuous

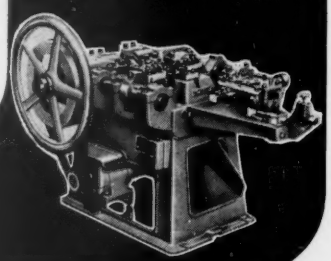
WIRE DRAWING MACHINE



CWD. 600/450
DOUBLE DECK TYPE

NON-STOP-COILER

NAIL MAKING MACHINE

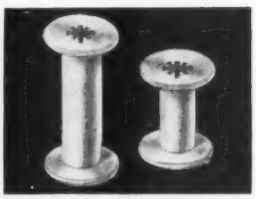


MAIN PRODUCTS:

*Nail Making Machinery
*Barbed Wire Making Machine
*Wire Drawing Machinery
*Auxiliary Equipment and Accessories of Above Machines
*Galvanized Sheet Flattener
*Sheet Corrugating Machine
*Galvanized Wire Take-up Machine

TANISAKA IRON WORKS LTD.
NO. 45, 1-CHOME, NAGASUNISHIDORI, AMAGASAKI, HYOGO, JAPAN
CABLE ADDRESS: GOLDENTANISAKA AMAGASAKI

PLAMENCO Nylon SPOOLS



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WIRE BRAIDERS

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- MADE IN STANDARD 16 AND 24 CARRIER SIZES

BRAIDER BOBBINS • COP HOLDERS
WIRE SPOOLS

Protect your wire with "PLAMENCO" for best results.

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CAMDEN WIRE CO., INC.

Wire Fabricators

PRODUCERS OF QUALITY FINE WIRE
COPPER CONDUCTORS

SOLID • BUNCHED • STRANDED OR BRAIDED

BARE • TIN OR LEAD COATED & SILVER PLATED

"Heavy Tinned"

CAMDEN WIRE CO., INC.
40 MASONIC AVENUE • CAMDEN, NEW YORK

cannot be overlooked. We do not use air transport extensively as yet, but we do find that the cost of sending samples of wire by air is not exorbitant, and if it was the means of obtaining a large order the cost spread over the tonnage of the order obtained is negligible. The normal use of air to transport wire and wire products, however, is not an economic proposition. For example, to America, excluding the trans-Atlantic flight, the cost of handling and on carriage would be extremely high.

* * *

However, it is a form of transport that cannot be disregarded and no doubt if the running costs of Airlines can be lowered, by the introduction of cheaper fuel, and larger capacity planes or if helicopters are developed to carry large cargoes, then no doubt the steel manufacturers will re-consider the use of air transport.

* * *

The advantage both from a cost and sales angle is the quick transit, the risk of complaint regarding damage by sea water or by change of temperature (atmospheric conditions) is minimised, and the need for packing is reduced.

* * *

The introduction at Farnborough this year of the Fairey Rotadyne showed that in the future the aircraft will be able to land on smaller areas and therefore if small airfields are set up in the lesser towns, it may become attractive to send wire and wire products domestically by air. In fact, in the very distant future one might buy a Rotadyne or similar aircraft, and operate from factory to factory (the estimated cost is £375,000).

* * *

It is obvious that congestion on the roads will still be a major problem even with the new trunk roads, and what an advertisement (and this could be translated into monetary terms) to have the first aerial radial delivery.

Warehousing

The necessity to warehouse goods will arise under four main headings:

1. **The purchase of supplies in bulk to obtain a lower purchasing price.**

2. When production is in excess of the space capacity in the works.
3. The holding of stocks for the buyer's convenience.
4. Goods held up in transit by dock strikes, delay of ships etc.

* * *

In a modern works, adequate provision is normally made for warehousing facilities, but in older works it could happen that space would be used for productive plant, rather than for warehousing.

* * *

Warehousing can be effected in various ways. The entire warehouse can be rented on an annual basis, or each consignment can be rated at a fixed charge per ton per week. In either case, additional cost will be incurred by transport in and out of the warehouse, and a double handling charge. The latter can be minimised by palletisation.

* * *

The railway also has a warehousing scheme for the convenience of traders. Briefly, the manufacturer despatches full load traffic to a depot, and at a later date, the railway despatches consignments from this stock to the various consignees. Warehousing charges are based on the number of square yards covered, and are usually quoted on an annual basis. Additional to this will be the "on-carriage" charge, plus labour and labelling charge.

* * *

One can only generalize on warehousing, as each manufacturer will have a different approach depending on the type of product and individual circumstances.

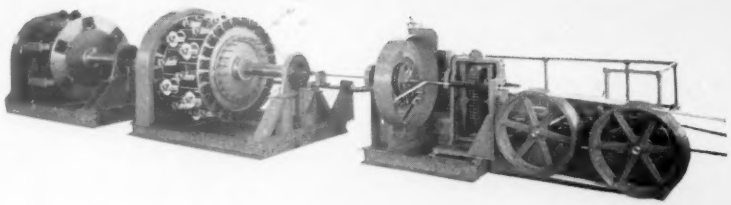
* * *

Since a warehouse owner has only a very limited liability (normally the acts or defaults of his own employees) it is customary to take out an insurance cover against such contingencies as fire or theft.

* * *

With regard to exports insurance can be arranged so that it applies from the time of despatch ex works to the date of delivery to the ship, or in the case of C.I.F. contracts, to the consignee abroad. The cost will be determined by the particular circumstances, including war risks, the value of the product, and overall claims experience.

30 CRADLE PLANETARY CABLING MACHINE



A very efficient machine built for producing cables where a small number of large conductors and a larger number of smaller conductors and fillers are used in the construction.

6-Cradle Section fitted with side opening cradles and accommodating reels 16 inches diameter and 9⅛ inches overall width.

24-Cradle Section fitted with fast loading and shaftless cradles having means for locking reels in place and eliminating side slap and accommodating reels 8 inches diameter and 5 inches overall width.

Filling Spindles for 24 yarn packages 3 inches in diameter and 6 inches long.

The concentric taping head accommodates pads 18 inches in diameter and 3 inches wide and is our constant tension type. It is driven through a clutch, counter shaft and variable speed device.

Capstans are dual 4 groove 30 inches diameter and are driven through a variable speed device.

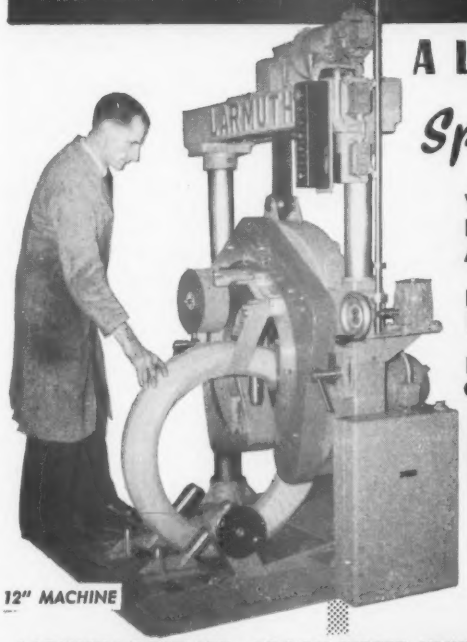
This Planetary Cabling Machine is one of a number which we have built handling reels 8, 10, 12, 16, 19, 24, or 30 inches in diameter. We can supply Standard Units to meet practically all requirements.

WRITE, WIRE, OR PHONE FOR FURTHER INFORMATION.

THE EDMANDS CO. 860 WELLINGTON AVE. CRANSTON 10, R.I.

HEAVY COIL WRAPPING MADE EASY WITH LARMUTH'S NEW 12" MACHINE

Now Glues The Paper As It Wraps



12" MACHINE

A LARMUTH *Spiral Wrapping* MACHINE

WITH PATENT MECHANICAL LOADING AND EJECTION

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2 COMPANIES

Supplying the needs of the wire industry in the West

First, there's Western Wire & Textile Machinery, Inc., the only company in the West that deals exclusively in used and reconditioned wire and cable-making equipment.

Secondly, there's the Paul I. Kenner Co., supplier and distributor of new wire and cable manufacturing machinery and supplies.

Nowhere else in the West will you have a better chance of finding exactly what you need - - - either new or used. Nowhere else in the West will you be able to trade in old equipment on new. Nowhere in the West will you find such a complete stock of machinery, equipment and supplies.

You'll like dealing with men who speak your business language - - - with companies backed by 20 years of highly specialized experience.

SOME USED EQUIPMENT ON HAND:

Braiders, Taping Machines, Used Watson and N.E. Butt Bunchers, 7 & 19 Bobbin Tubular Stranders, Used Syncro 61 Bobbin Planetary Strander.

EQUIPMENT

Enameling Equipment — Extruders
Takeup Equipment — Payoff Equipment
Spoolers — Respoolers
Measuring Machines — Capstans
Cable Strippers — Braiding Equipment
Twinners, Stranders, Cablers, Bunchers
Spark Testers — Printing Machines
Spiral Striping Machinery — Taping Equipment
Fine Wire Takeup and Respooling Equipment
Wire Drawing Machines
Specially Built Equipment . And Much More

SUPPLIES

Wire Drawing Dies — Wire Drawing Spools
All Types of Reels and Spools
Lithographed Spools
Inks for Printing Machines
Bare, Tinned and Silver Plated Copper Wire
Numerous Other Items

TRADE YOUR OLD EQUIPMENT FOR NEW

WWT MACHINERY, INC.
WESTERN WIRE & TEXTILE MACHINERY, INC.
228 Shaw Road — South San Francisco, Calif.

PAUL I. KENNER Company
228 Shaw Rd., So. San Francisco, Calif.

Two companies that provide all that's needed, new and used for the West's wire industry

Statistics

The very mention of statistics and percentages, will always evoke the remark that figures can be distorted and that each side can present so many figures that statistics can become almost meaningless. However, we have found from experience that statistics and visual presentation of past and current costs can be most useful.

* * *

A clear example of this was shown when the Railway introduced their new "loadability" rates scheme. Several diagrams were drawn showing clearly the type of product on which the increase would be the heaviest. Obviously, from the outset it was clear that the smaller consignments (under 2 tons) would bear the highest increase, and it was shown by means of a bar chart that the further the goods were sent, the smaller the percentage increase. Another diagram was drawn showing the old and new rates. This also emphasised the gap between them and the steeper rise in cost per mile on the 2 ton and under 2 ton consignments. In addition it became clear that the introduction of a minimum charge as for 10 miles (as against the former six miles) would mean that even larger weights, such as 10 ton consignments were not an economic proposition for short distance traffic in the absence of "exceptional" rates.

* * *

Under the former charging scheme, the cost per mile was reduced as the distance increased, but on the new charges scale, the cost per mile does not alter whether goods are sent 20 or 200 miles.

* * *

We find it very useful to produce statistics for all transport distribution costs, outward, regardless of distance. Thus for a fictitious month the figures would be as follows:

	Weight	*Cost*	*Average Cost*
Railway	10,000 tons	£20,000	£2 per ton
Road	10,000 tons	£15,000	30/–d per ton
Combined Total	20,000 tons	£35,000	£1.15.0d. per ton

If the following month showed a sudden increase in cost per ton then a closer examination of the figures would be advisable. The explanation may be, a) a percentage increase of either road or rail rates, or b) a change in the incidence of traffic. When the latter is examined it may be found that more traffic is going longer distances, or alternatively if there is a fall in exports which are usually short distance traffic at low rates, then the overall inland transport cost per ton will rise.

* * *

If a manufacturer employs several contractors, it is advisable to have individual analysis made of all traffic carried, every six months. Sometimes it is found that the traffic may have increased and therefore it may be possible to obtain a better rate, on the other hand, if the traffic has seriously declined, the contractor may ask for a higher rate, and when negotiating any changes in rating, it is very helpful to have the full facts.

* * *

The most useful analysis is one showing the number of consignments, weight, and the distance carried, in 25 or 50 miles belt.

Complaints

This may not at first appear to have any connection with the economic aspect of transport, but the maintenance of high standards on one hand and the human element on the other may lead to additional carriage costs.

* * *

The complaints which arise from damage in transit can be rather costly. (If sent by passenger train only 75% of the value can be recovered). The replacement of damaged goods may mean the re-tooling of machines, re-invoicing and very often protracted correspondence.

* * *

All complaints should be investigated, classified and effective steps taken to avoid recurrence.

* * *

A monthly graph portraying the complaints in respect of individual products, the distances carried, and the mode of transport used, can prove particularly useful.

Conclusions

Transport and associated activities is a subject that could be expanded. The main object of the paper has been to indicate the methods of despatching, the various charges that would have to be contemplated in each case, and the research which has been found to be essential in assessing the cost of Transport in industry.

Alpha Metals Announces New European Plant

Alpha Metals, Inc., Jersey City, N.J., producers of electronic materials, has opened a sales and manufacturing division in London, England. The new plant occupying 2,000 square feet, began operations in July.

* * *

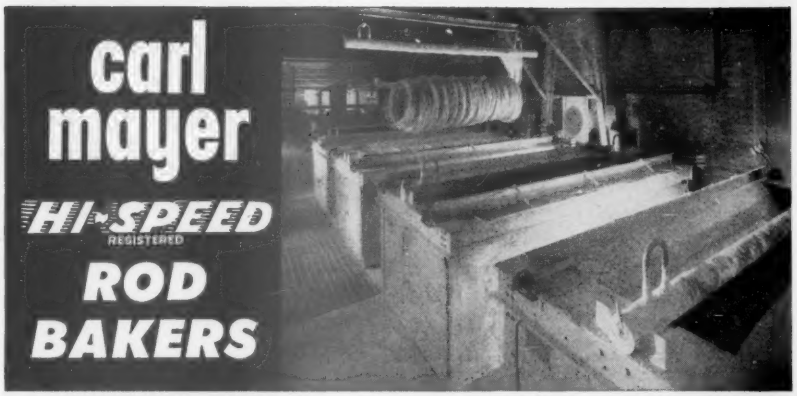
Philip Baksh, presently resident European representative of Alpha Metals, Inc., heads this overseas operation.

* * *

This European division was set up to supply semiconductor device manufacturers in the United Kingdom and on the Continent with the high purity microminiature metal forms used in transistors, diodes and other semiconductor devices. Materials will be supplied in the form of spheres, pellets, washers and solder preforms. It also will make special continuous conductive solder-coated base metals for base tabs produced exclusively by Alpha Metals and used in the production of germanium devices, according to **Harold Hertzog,** President.

Revised Edition of "Tool Steel Simplified"

Latest developments in the fast changing field of tool steels and their application to tools and dies are described and interpreted in



Faster baking, greater fuel economy, maximum production efficiency are just a few of the results of the exclusive heating arrangement of the Carl Mayer Hi-Speed Rod Baker. It also has a patented blow-off feature which removes moisture without damage to coils.

Here are just a few of our many satisfied customers:

American Steel & Wire Co.
Atlas Steel Co.
Colorado Fuel & Iron Corp.
Crucible Steel Co. of America
Driver-Harris Co.
B. Greening Wire Co., Ltd.
Indiana Steel & Wire Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
Sheffield Steel Div., Armco Steel Corp.
Steel Company of Canada

WRITE FOR LITERATURE

Patent Nos.
U. S. A. 2,296,361
2,323,828
2,235,559
Canada 396,144
401,589

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20800 CENTER RIDGE RD., CLEVELAND 16, OHIO
OTHER PRODUCTS: Core Ovens • Mold Ovens • Welding Rod Ovens • Heat Treating Ovens & Furnaces • Special Processing Equipment and Accessories.

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SPECIALIZED MACHINERY
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Continuous Tension Control
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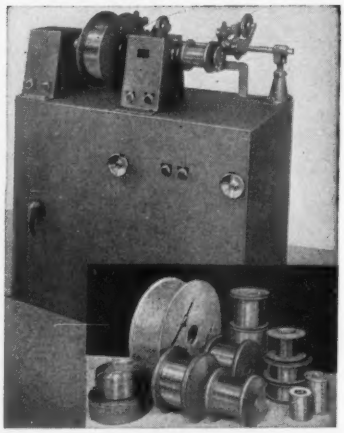

SPECIFICATIONS

Size Range: .010" to .080" or heavier if soft, and many flat wire sizes. Max. Spool Size: 16" flange diam. Capacity: Usually 2 to 6 spindles.

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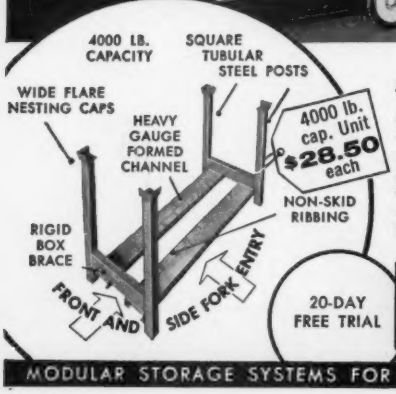

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the third and completely revised edition of "Tool Steel Simplified", published by **The Carpenter Steel Company.**

* * *

This volume, first printed in 1937 and revised in 1948, has again been expanded by the original authors, **Frank R. Palmer** and **George V. Luerssen.** It is written especially for men who design, make, and heat treat tools and dies.

* * *

The book's fundamental purpose is to "present simplified methods for selecting and heat treating the proper tool steel to make any kind of tool."

* * *

Two new chapters have been added to advise the tool and diemaker on hot work steels and air hardening steels—two new groups of tool steels which have greatly increased in importance in recent years. A chapter on high speed steels has been rewritten to fit the almost universal changeover from tungsten high speed steels to the molybdenum types.

* * *

The book may be ordered from The Carpenter Steel Company, Reading, Pa. Containing 595 pages, it sells for $2.50 per copy in the U.S.A. and $3.00 elsewhere.

Kaiser Appoints Distributor

Industrial Aluminum Company, Inc. of Waltham, Mass., has been appointed a distributor of Kaiser Aluminum sheet, plate, rod, bar, wire and extrusion products, it has been announced.

* * *

With new warehousing facilities in Bear Hill Industrial Park on Route 128 in Waltham, Industrial Aluminum serves the New England area. The company was formed in January of this year by **R. W. Clare** and **C. A. Foote** to specialize in service to aluminum users.

* * *

The Industrial Aluminum Company warehouse is fully equipped with stocking, cutting and handling facilities.

Two New Modern Plants Dedicated

(*Continued from page* 1023)

handling 5,000 pounds an hour); these electrically-driven mixers drop the batch into a "strainer extruder" on the floor below, that forms the raw rubber into a continuous 20-inch belt or ribbon; the ribbon is then carried by conveyors through cooling, drying, and curative processes and automatically slit into narrower strips.

* * *

In the insulating plant—750 feet long—copper or aluminum conductors, produced in another Hatfield Division plant, are insulated with rubber fed simultaneously at high speed into huge, 250-foot-long "continuous" extruding and vulcanizing machines, where the rubber is extruded onto the wire and is simultaneously vulcanized under 250-pounds steam pressure. On its 250-foot return trip, the cable is cooled and then automatically reeled. The plant has eight of these continous cable-making lines.

* * *

Once rubber-coated, the wire or cable goes through any number of different processes, depending on whether it will be used for electrical appliances, building wire or communications or power cable.

* * *

More than 100 automatic braiding machines, each capable of braiding up to 24 spools of yarn at once, apply braid to the wire or cable.

* * *

Depending on use or design specifications, after braiding the wire or cable is coated with oil-resistant lacquer, with lead or with saturants and finish coatings of paints. In some instances, instead of braiding, additional rubber jackets may be applied.

* * *

For heavier cables, including utility power cables capable of handling up to 15,000 volts, the plant has a huge continous lead press where the cables are wrapped in a lead jacket and "cured" under tremendous steam pressure.

* * *

The new production facilities, together with some projected plans, are designed to make Hatfield a

INSULATING DIES AND NOZZLES

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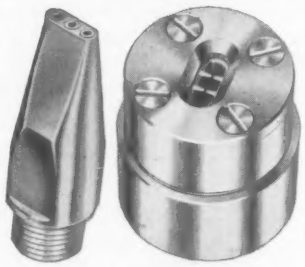
EXTRA-HIGH ELECTRIC WIRE PRODUCTION



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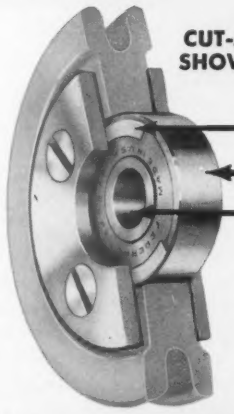

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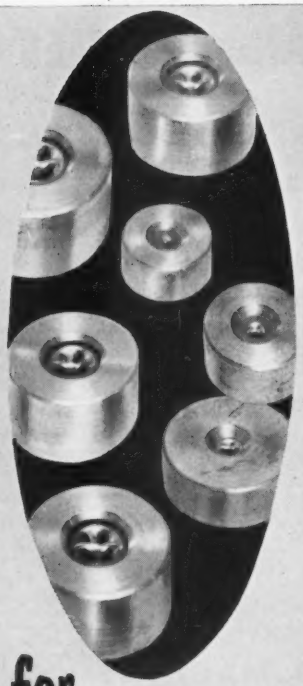

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. . . or write for Technical Bulletin HW-49

HYPREZ DIVISION
ENGIS EQUIPMENT CO.
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fully integrated manufacturing enterprise, **Mortimer S. Gordon,** President, stated at the dedication ceremonies. While these new facilities are believed to be the lowest-cost producing units of their kind in the country, additional economics are anticipated when the Union and Hillside units are moved to Linden further to reduce materials handling costs.

Pneumatic Conveyor Paves Way for Production Speed-Up

(*Continued from page* 1029)

ultimately directed to storage.

* * *

Special design permits this phase of the conveying system to accomplish its three-in-one job. In order to cool the PVC, the system has an 18-in. diameter conveying line, three times as big as lines used in most installations. Suction action is provided by a large 30-hp fan instead of the usual blower.

* * *

Under previous methods each step in the blending process was conducted manually. After the ingredients were mixed they were removed from the blender and loaded into a cooling bin. When cooled to the required 100°F the entire batch was distributed among 55-gallon drums (about 300) and stored. These three steps, which took considerable time and effort, were consolidated by modernized handling.

Additional Bonus: Space

In addition to the several direct benefits provided by the system, Circle Wire and Cable has accrued a number of extra advantages. Eliminated are 400 storage drums used under the old handling system—drums that took up 1,000 sq. ft. of valuable plant space. Now, premium factory area is available for expansion and other productive purposes. The system is completely enclosed. Dust is collected and kept out of the atmophere, impurities are kept out of the system and away from the plastic materials.

* * *

The Dracco installation represents one further aspect of Circle

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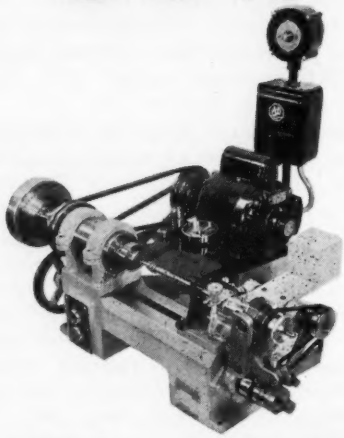

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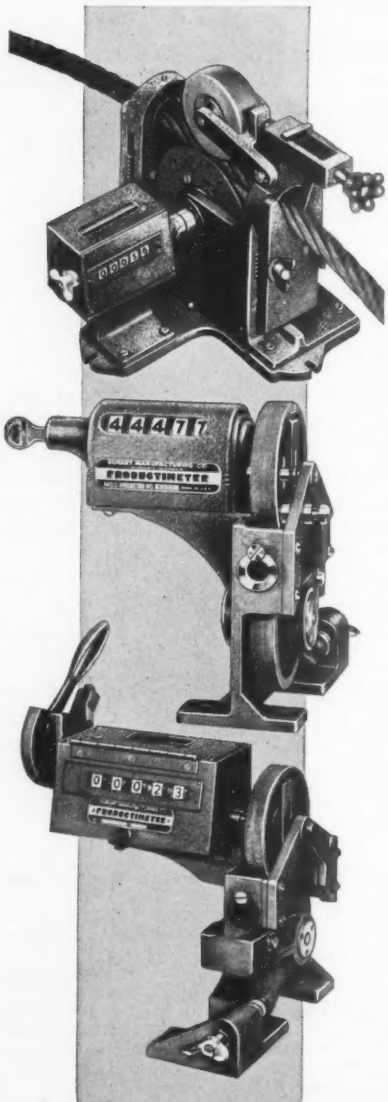

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COUNTING INSTRUMENTS

Wire and Cable Corporation's efforts to maintain its competitive situation in an industry that is constantly changing.

New Vulcanizable Polyethylenes for Wire and Cable Insulation

Two new unusual wire extrusion compounds, designated as vulcanizable polyethylenes, have been announced by **Union Carbide Plastics.** The new Bakelite products offer a combination of improved physical and thermal properties unmatched by available thermoplastics for insulation and jacketing.

* * *

Immediately after the extrusion operation these materials are chemically crosslinked by passing the insulated wire or cable through a continuous vulcanizer. Under these conditions reactive sites form on the polyethylene molecules and chemical crosslinking takes place.

* * *

Thermoset properties are imparted to the compounds — dimensional stability at elevated temperatures is greatly improved and stress-cracking is eliminated. At the same time, the excellent abrasion and impact strength, tensile strength, chemical resistance, aging and weathering over a wide temperature range, and other desirable properties of conventional polyethylene are retained.

* * *

One, HFDA-4201, in natural and colors, is a vulcanizable polyethylene for use as primary insulation in high voltage cable where it will permit operation at considerably higher temperatures.

* * *

A second compound, HFDA-4203, provides an optimum balance of physical properties and flexibility for line wire and service drop insulation. On these applications, the lighter weight and smaller diameter of vulcanized polyethylene insulation result in easier handling and allow the use of longer spans, compared to thermo-setting rubber materials.

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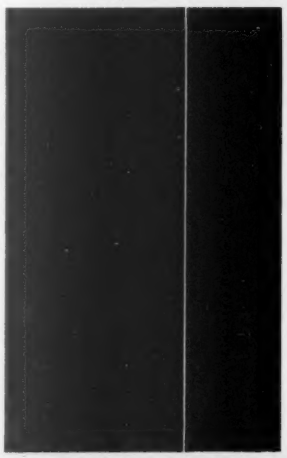

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New Maintenance Booklet

A new 16-page picture booklet, presenting helpful facts about making maintenance and repair parts, has been made available by **La Salle Steel Company.**

* * *

The booklet, entitled "One Way to Make Your Job A Little Easier," will be of particular interest to maintenance executives, engineers and other key maintenance personnel. The new booklet offers solutions for those persons faced with the problem of getting machinery repaired and back into production fast and at minimum cost. It will also prove helpful to designers, production and research men who must make any kind of special machinery or equipment requiring machine parts.

* * *

Presented in graphic photo-caption format, the booklet offers ideas on how to save time in machining parts, eliminate heat treating, quench cracks and last minute parts rejections. It also offers suggestions for avoiding secondary operations such as cleaning, straightening, finish grinding, and inspections . . . which will help get equipment back into operation in hours rather than days.

* * *

Included in the booklet are physical properties, chemistry and tolerances for Stressproof Steel Bars, widely used in both production and maintenance and parts applications.

* * *

Free copies may be obtained by writing La Salle Steel Company, P. O. Box 6800-A, Chicago 80, Illinois. Ask for Bulletin No. 24.

Belden Licenses Channel Master

Belden Manufacturing Company, Chicago, Illinois, has issued a license to Channel Master Corporation, Ellenville, New York, for the manufacture of Belden twin-lead foamed polyethylene transmission line cable — U. S. Patent No. 2,782,251. This is in accordance with mutually agreeable terms of settlement in a legal action brought by Belden against a customer of Channel Master, charging patent infringement.

Some Theoretical and Practical Aspects of the Normal Force Effect in Polymeric Liquids and Melts

(*Continued from page* 1009)

the bob. The flow pattern eliminates the knitting problem often associated with conventional cross-head die wire coating.

* * *

Another possible utilization of the melt elastic extruder in the wire coating industry is as a replacement for conventional coating dies. A melt elastic extruder could be fed by a conventional extruder mounted perpendicular to the melt elastic extruder. The wire to be coated would pass through the rotating member and out the die. The advantages of this combination over a conventional crosshead die would be elimination of weld lines and better utilization of coating material. The possibility exists that the coating thickness can be reduced because of the elimination of the weld line and the spiral wound nature of polymeric coating.

Acknowledgements

The authors wish to thank Professor Bryce Maxwell of the Princeton Plastics Laboratory for his encouragement and assistance, and the Editors of **Modern Plastics** for permission to use segments of this paper.

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Conclusions

1. The Weissenberg equations for normal force effects appear to be applicable to dilute solutions and even polymer melts.

2. Polymer melts exhibit a strong normal pressure force effect. This effect can be used to extrude plastics at rates and efficiencies comparable to the conventional screw extruder.

3. Since only a small amount of polymer in the form of a thin section is being heated at any given time, heat transfer is facilitated and the problem of heat degradation is reduced due to the short residence time. Residence times of less than 9 sec. have been measured in this new device.

4. Mixing and dispersion can be achieved in a short time due to the intensive local shearing of the material. Carbon black dispersions in polyethylene with good background can be achieved even with these low residence times.

5. Cross-linking during extrusion is possible in this machine since the elastic charter of the melt, responsible for the pumping action, is increased by the development of cross-links.

6. The extruder can be used to degas or dry materials by controlling the compression ratio.

7. Because of the unique design, pressure pulsations at the die are not a problem.

8. The melt elastic extruder offers a unique method of applying strain free polymer to a moving wire.

Roll Threading of Fasteners

(*Continued from page* 1016)

are spark plug threads; all the various types of pipe threads; coupling threads for hose couplings and nipples; lag screws; and all types of tapping screws and regular machine screws. Other forms are drive nails; screw extractors; screw shells for lamp sockets; external splines on gear and axle shafts; knurls; ribs; annular rings; and oil grooves.

* * *

Samples of some of these products are available here for your comments and inspection.

To summarize, roll threads have the advantages of increased strength, better fatigue resistance, material savings, accuracy and uniformity, high degree of surface finish, speed and economy, and extreme versatility of application.

Rhodesian Mill on Full Production

The Lancashire Steel (Rhodesia) Pvt., Ltd., Que Que, Southern Rhodesia, this spring emerged from a pilot plant production status to full production on low carbon wire, and now is supplying wire for Rhodesian and Nyassaland needs at the rate of 12,000 tons per year.

* * *

The firm was organized two years or so ago and its mill is operated under the general management of K. W. Scott, who recently became a member of the Wire Association.

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Progress Report on Molybdenum Disulfide as a Copper and Copper Alloy Drawing Lubricant

(*Continued from page 997*)

soluble soap lubricant has found moly to be very helpful. In testing, normal approach angles were reduced 20%. Starting at a 600:1 dilution of the "#110 Suspension", this mill gradually increased the moly concentration to a 180:1 dilution at which point die life had increased threefold, amperage was down 10%, and surface finish was brighter and more uniform. One very important factor in this mill is that breakage has been reduced 85% upon adoption of moly.

Case Reports on Drawing Phosphor Bronze with Moly

CASE #15: In drawing phosphor bronze from .054″ down to .010″ through diamond dies, one company has found the "#110 Suspension" very important in increasing die life and improving surface finish. Initial dilutions of the "#110" in a water diluted soap compound showed no improvement. At 200:1, die life increased 25%, amperage dropped off 8%, and surface finish improved. At 150:1, die life had improved to 85%, and amperage dropped 14%. At 100:1 and 75:1, increased amounts of the "#110" caused formation of moly in die reducing angles, and consequently die life fell off. However, at these strong concentrations surface finish and amperage remained improved. In all testing approach angles were kept at normal.

CASE #16: One mill drawing phosphor bronze from .128″ to .050″ through carbide dies found that additions of the "#110 Suspension" in the breakdown drawbox improved die life only slightly, although surface finish was improved markedly. Having started at a 180:1 dilution only in the drawbox of the multi-pass wet machine, the company gradually increased the "#110" content in the soap paste to a 25:1 dilution. At this point the maximum increase in die life for all dies was 5%, but the improved surface finish warranted the use of the "#110 Suspension". No changes were made in the reducing angles.

CASE #17: Another mill drawing phosphor bronze with oil from .250″ rod to .014″ through carbide and diamond dies has decided on a 125:1 dilution of the "#140 Suspension" in a drawing oil; die life increased more than 100%, while amperage decreased 5%. The mill also reports that surface finish has improved considerably. Experiments conducted at stronger concentrations showed a tendency toward lower die life. During the tests, approach angles were 10% below normal.

CASE #18: In drawing phosphor bronze from .250″ to .050″, this company ran tests at 400:1, 300:1, and 200:1 dilutions of the "#110 Suspension" in a water diluted soap lubricant. At 400:1, no improvement was noted but at 300:1, die life jumped 175% while amperage and surface finish remained unchanged. At 200:1, die life remained at the 175% increase, and surface finish improved so little that the company established 300:1 as the desired dilution ratio. No changes were made in die angles throughout the testing.

CASE #19: In single pass drawing of phosphor bronze, an Eastern mill adds 3% "Pure Moly Powder" by weight to a soap compound in the drawbox when taking a 30% reduction on .825″ rod. This mill reported improved surface finish and nearly a 40% reduction in amperage, although no substantial change occurred in die life. No attempt was made to change die reducing angles.

CASE #20: In water soluble drawing of fine diameter phosphor bronze from .047 through diamond dies, a Midwestern mill found that a 200:1 dilution of the "#110 Suspension" increased die life an estimated 250%. At this dilution, the mill reported a 9% power decrease, improved surface finish, and drastically reduced breakage. Initial tests performed with normal approach angles showed only slight gains in efficiency, and as a result, final testing was carried out at approach angles which were reduced 22% from normal.

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Case Reports on Drawing Beryllium Copper with Moly

CASE #21: A midwestern mill drawing beryllium copper from .125″ down to .008″ through both carbide and diamond dies pretreats the cleaned wire in a bath composed of a 24:1 dilution of the "#110 Suspension" in water. After dipping and air-drying, the rod is then drawn through a drawbox filled with 5% by weight "Pure Moly Powder" in a soap paste. Subsequent drawing is done with a 150:1 dilution of the "#110" in a water diluted soap bath. Die life increases have been estimated at 150-200%, amperage has dropped off 16%, and surface finish has improved. All testing was conducted with dies having an approach angle 15% below normal.

CASE #22: In oil drawing beryllium copper from .051″ to .008″ through diamond dies, this firm started testing the "#140 Suspension" at a 200:1 dilution in a drawing oil. At this concentration surface finish improved slightly, but die life and amperage remained the same. At 150:1, surface finish again improved but without a change in die life or amperage. At 100:1 and 75:1, surface finish remained excellent and die life increased 50%, while amperage remained unchanged. At 50:1 no further improvements were noted and testing was halted. No changes in die angles were made.

CASE #23: An Eastern mill wet draws beryllium copper from .250″ down to .045″ through carbide dies on multi-pass machines. Procedure at this mill involves moly-soaping of the rod prior to drawing. To a water diluted soap bath this mill adds 5% by weight "#110 Suspension". The rod is dipped in this bath and then air-dryed. It is then drawn through a breakdown die without any additional lubricant and proceeds to the wet dies. In the wet drawing, a 250:1 dilution of the "#110 Suspension" in a water soluble soap bath is used. The 250:1 dilution was established after tests at 350:1 and 300:1 were conducted and resulted in only marginal increases in die life. Breakdown die life has increased nearly 200% by this method, while estimated wet die life has increased about 125%. The mill also reports better surface finish, but no substantial change in amperage readings.

Case Reports on Drawing Cupro-Nickel with Moly

CASE #24: One mill, drawing cupro-nickel from .128″ down to .051″ through diamond dies in a multi-pass wet machine, reports die life increases of 50% when using a 25:1 dilution of the "#110 Suspension" in a soap paste at the breakdown die only. Tests were started at close to a 200:1 dilution and concluded when die life reached its optimum at the 25:1 dilution. Also reported is that moly has produced an excellent finish on the drawn wire. No changes were made in die approach angles.

CASE #25: In oil drawing cupro-nickel from .250″ rod down to fine shaped sizes, this company ran initial tests with moly, and due to moly accumulation in approach angles, completed testing at angles which were 20% below normal. At a 300:1 dilution of the "#140 Suspension" in a drawing oil, die life increased slightly and surface finish improved markedly. At a 200:1 dilution, die life increased by slightly over 100%, and surface finish remained excellent. At 150:1 and 100:1, no improvement was noted and further testing was discontinued.

* * *

The initial successes achieved by these mills over the past few months indicate that moly additives will play an increasingly larger part in the drawing of copper and copper alloys in the near future. As pretreatment of metals becomes more common and more is known about the factors influencing dilution ratios and die approach angles, it is expected that

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Many Other Items

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increased productivity and quality can be obtained with moly.

Shaped Wire Manufacturer Moves to Larger Plant

New equipment, a new and larger location, and a new corporate identity are announced by **Radcliff Wire, Inc.,** formerly Radmetz Wire, Inc. The main offices and plant of the firm are now located at 165 Riverside Ave., Bristol, Connecticut, providing needed space for increased production facilities and an enlarged quality control area, as well as more room for stocking raw materials and finished production. The new corporate name more closely links the firm with its founder and president, **Donald F. Radcliff.**

* * *

The company produces tailor-shaped wire in coils—flat, square, triangular, and many and varied special profile shapes — from any workable metal including: brass, copper, high-carbon steel, monel, phosphor-bronze, nickel, nickel-silver, inconel, aluminum, silver, stainless steel, and resistance wire. Other metals, for special uses, are also available.

* * *

New equipment for more production accuracy and speed has been added to the Radcliff production lines. Now, the company routinely produces profile wires at a ±.0005-inch tolerance, far more exact than the usually accepted industrial standards of accuracy. Flat and ribbon wire normal tolerance standards at Radcliff are now ±.003-inch. This degree of accuracy, only months ago, was considered by the nation's industries as a "special" and was a premium product. This tolerance standard is now routine at Radcliff Wire and requires no extra charge.

* * *

Revised Information Bulletins are available on direct request. They describe the details of the firm's operations and services, outline ordering information, and illustrate some of the wire profiles available.

Valve Solves Compressed Air Moisture Problem

A new valve that automatically and continuously eliminates water and oil condensation from compressed air lines without causing pressure drop has been perfected by the **Barger Manufacturing Company,** 204 Foshay Tower, Minneapolis 2, Minn.

* * *

Called the "Moisture Minder", it can be readily attached to existing compressed air systems without cutting lines. According to the manufacturer, installation is inexpensive and is performed in a matter of minutes. It rarely needs attention or servicing and will not balance off and bleed air from the system.

* * *

The unit is just under six inches in length, is 1-1/4 inches in diameter and is threaded to fit a standard 1/4 inch pipe. Valves to fit other pipe sizes are furnished on request.

Portable

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For fast, clean, silver brazing of wire. Requires less skill and instruction than gas brazing. Produces consistently good welds.

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The Twentieth Century Renaissance in the Steel Wire Industry

(*Continued from page* 994)

The wire industry can be justly proud of these achievements of the past thirty years. The future will witness continued efforts to improve the efficiency of all operations with the aim toward a better product with a lower cost of production. This will be especially important where substitutes for wire pose a threat from an economy standpoint. A current illustration is the application of polyester "foam" to replace wire springs in the bedding and furniture field. Other substitutes for wire are in the making and their chances for adoption will most likely depend on their cost as compared to that of wire.

* * *

The progress of the wire industry in future years will be dependent not only on the improvements of its present production processes and the quality of its products, but to a much greater extent than in the past on its success in enlarging the field of application through the development of new products.

Address to Electric Wire and Cable Section

(*Continued from page* 999)

connections involved, and the millions of wire-wound components, he can only conclude that wire must perform its functions with an extraordinary degree of reliability. So may I congratulate you on being makers of or being otherwise associated with one of the most dependable products of which I know. May I further congratulate you on the quality control, the integrity of purpose, and the technical competence which has made wire the excellent and indispensable product that it is.

* * *

Clem Lawson has suggested that before concluding, I mention other work done at the Laboratories, preferably with some sort of demonstration. Since it is not within my ability to demonstrate a communications satellite nor a submarine cable system, I have chosen to show you a development which many people consider the outstanding one of its kind in this century.

(At this point Mr. Nossaman threw a switch on a small box. The cover opened, a hand came out, shut off the switch, withdrew, and the cover closed itself.)

* * *

Finally, I want you gentlemen all to know what a pleasure it has been to have you as our guests today. We hope that your visit has been interesting and that you have been able to get some feel for the work we do in helping to make telephone service better, more convenient and useful, and to keep the cost of such service as low as possible.

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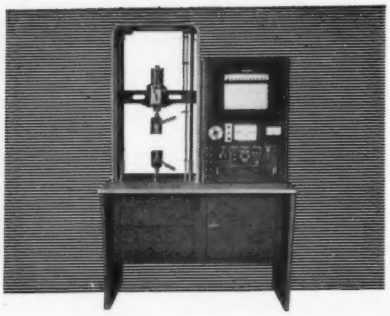

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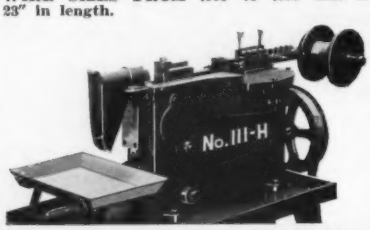

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New Themocouple Alloy

Platinel,* a noble metal thermocouple combination, has been developed by Engelhard Industries, Inc. for temperature measurement.

* * *

The new thermocouple wire was developed by Engelhard in response to demands for thermocouple material with an electromotive force output equal to Chromel-Alumel,** and a high degree of stability over an extended temperature range.

* * *

The new thermocouple combination has been used in jet engines, gas turbines, nuclear reactors, and other applications where operating temperatures have restricted the life of base-metal thermocouples.

* * *

Initial tests indicate a drift of only two degrees in emf output after a 2500 hour test at 1300° C. By utilizing gold, palladium and platinum, Platinel resists oxidation at these temperatures, thus extending the useful range of the emf-temperature curve, and reducing maintenance costs.

* * *

The thermocouple wire, obtainable in all sizes, is designated as Platinel 1786 for the positive leg (an alloy of gold, palladium, and platinum) and Platinel 1503 for the negative leg (an alloy of gold and palladium). An alternate choice, Platinel 2, is available for the positive leg where maximum structural strength is required, since it has twice the tensile strength of Platinel 1786 at high temperatures.

For further information, write to: Instrument & Systems Section, Engelhard Industries, Inc., 850 Passaic Ave., East Newark, N.J.

* Platinel is a registered trademark of Engelhard Industries, Inc.
** Chromel-Alumel is a registered trademark of Hoskins Manufacturing Co.

G. E. Opens San Francisco Office for Silicone Sales

The Silicone Products Department of General Electric Co. has opened a sales office in Burlingame, Calif., located at 1229 Burlingame Avenue, with **Red Baurmeister** in charge. His business telephone is Diamond 4-5757.

* * *

The San Francisco area, formerly serviced from Los Angeles, will now be covered by the Burlingame office. According to sales manager **K. J. Morray,** this expansion of sales coverage will mean improved service to area customers.

* * *

The General Electric Silicone Products Department manufactures silicone rubber compounds, resins, fluids, emulsions, and specialty products as well as silicone intermediate chemicals. The manufacturing, research and marketing facilities for General Electric silicones are located at Waterford, New York.

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Telephone: WAbash 5-2456

A Unique and Unusual Use of Wire

(*Continued from page* 1013)

also, since the pitch determines whether the rods in their finished shape will be properly spaced when installed. The pitch length is determined by measuring the length of a known number of pitches and then performing a simple division. Wire samples are taken randomly and tested for tensile strength, elastic limit, temper and coating thickness.

* * *

In addition, other tests are performed during manufacture, and final, destructive testing is continuously being done in the laboratory to determine overall strength in static tension and the number of applications the product will withstand. Fatigue testing is also done, due to the fact that conductors and guy strands are continuously subjected to reversed bending stresses caused by aeolian vibration. Other properties necessary in the satisfactory performance of our products are good resistance to stress corrosion and, for certain products, good thermal and electrical conductivity.

Product Usage

Our first product was the aluminum alloy Armor Rod mentioned earlier. In addition to protecting a conductor at a point of suspension, it also serves as an excellent mounting point for vibration damping equipment and spacing units. The Preformed Armor Rod was followed by our other high volume product, the Guy-Grip Dead End, also mentioned before. To a great extent the Guy-Grip has replaced the old style bolted clamp-type device which one can so easily see on guy wires from pole to ground and from pole to pole. Not only do these Guy-Grips out perform the clamps, but they also add to the overall appearance of the pole-guy installation. The Preformed Splice is used to splice two conductor ends together, and saves material due to the fact that the splicing can be done between supports in a span. The Preformed Tie is used in conjunction with Armor Rods to tie a conductor to an insulator.

* * *

We also manufacture a number of extruded plastic products, including a Plastic Guy Guard to replace the galvanized guards now in use, a Plastic Spiral Vibration Damper used in conjunction with the Armor Rod to reduce aeolian vibration, a Plastic Tree Guard to protect a conductor from abrasion from a tree or other hazard, and a Plastic Spacer Unit used to restrain two conductors from physical contact.

Conclusion

This new and unique product line has revolutionized the industry it serves. Engineers and contractors have found there are definite economies in using these products, since much installation time is saved, and also field crews need less training due to product simplicity. Exhaustive tests performed by our laborato-

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Bearing Company Building New Wire Mill

The Torrington Co., Torrington, Conn., is undertaking a $6-million expansion program to provide a new bearings manufacturing plant near Clinton, S. C., and a wire mill adjacent to its Broad Street Plant in Torrington.

* * *

The wire mill will be a 43,000 square foot plant. Torrington plans to draw its own wire from rods for use in the manufacture of needle rollers and needle bearings. The building will be completed by September and equipment installed during October and November.

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For Precision Wire Drawing
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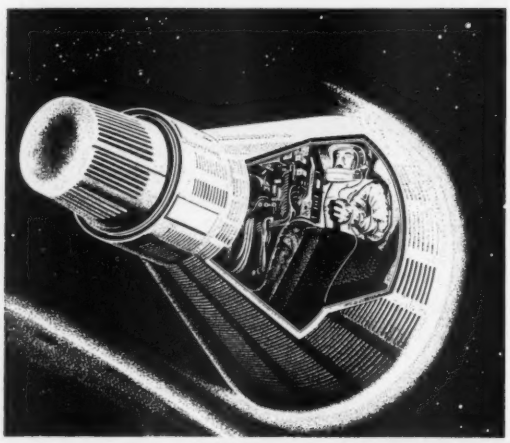

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Engineer Joins Edmands

Konrad C. Schillebeeckx, formerly with **The Phillips Electrical Co. Ltd.**, has joined **The Edmands Company**, as Chief Engineer and Assistant to the President for Special Assignments, according to **Sidney B. Blaisdell**, President.

* * *

Mr. Schillebeeckx graduated from the University of Louvain in Belgium with great distinction and holds degrees in Mechanical and Electrical Engineering. Subsequently he secured degrees in Business Administration and Management from McGill University in Montreal. He has been Plant Engineer for the last 10 years at Phillips Electrical Company's plant in Montreal.

* * *

The Edmands Company, Cranston, R. I., manufacturers of insulated wire machinery, specializes in twisting machines and cables.

New Thermocouple Wire Catalog

A new, 10-page catalog describing the processes used to produce Tempak thermocouple material is now available from **Temptron, Inc.**, 7030 Darby Ave., Reseda, Calif., national specialist in the field of temperature measurement.

* * *

In addition to specifications and descriptive data on the metal-sheathed, ceramic-insulated wire, the catalog, designated Tempak/2550, also describes Temptron's unique facilities and its comprehensive in-process quality control system.

REELS
Wood, Plywood, Hardboard
8" to 72" in diameter
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TENSION METERS
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Coatings on Stainless Steel and High Nickel Alloy Wires

(*Continued from page* 1020)

We, at Techalloy, are continually looking and searching for better coatings and ways to improve existing coatings in order to make it easier for our customers to process our wire.

* Trademark, The International Nickel Company.

TABLE I
METHODS OF REMOVING COATINGS AND LUBRICANTS

	18-8 STAINLESS	INCONEL	"INCONEL" X"	"MONEL	NICKEL
LEAD	15-20% NITRIC 140-160° F 30 min.-1 hr.	15-20% NITRIC 140-160° F 30 min.-1 hr.	DO NOT USE	DO NOT USE	DO NOT USE
COPPER	15-20% NITRIC 140-160° F 30 min.	15-20% NITRIC 140-160° F 30 min.	15-20% NITRIC 140-160° F 15-30 min.	15-20% NITRIC 140-160° F CHECK EVERY 30 SEC. UNTIL COPPER IS REMOVED. RINSE.	15-20% NITRIC 140-160° F CHECK EVERY 30 SEC. UNTIL COPPER IS REMOVED, RINSE.
SOAP & LIME	1. SODIUM HYDRIDE 2. 10% SULFURIC 15 min. 3. 20% NITRIC 5% HYDROFLUORIC CHECK EVERY MIN. UNTIL OXIDE IS REMOVED. RINSE	NOT USED	NOT USED	NOT USED	NOT USED
STEARATE	15-20% NITRIC 140-160° F 15-20 min.	15-20% NITRIC 140-160° F 15-20 min.	NOT USED	15-20% NITRIC 140-160° F CHECK EVERY 30 SEC. UNTIL COATING IS REMOVED. RINSE	15%-20% NITRIC 140-160° F CHECK EVERY 30 SEC. UNTIL COATING IS REMOVED. RINSE.
CHLORINATED PARAFFIN	TRICHLORODETHYLENE VAPOR DEGREASE	SAME TREATMENT	SAME TREATMENT	SAME TREATMENT	SAME TREATMENT
MOLYBDENUM DISULFIDE	2½% NITRIC 2½% SULFURIC 15% HYDROCHLORIC IMMERSE 1 MIN. RINSE	NOT USED	NOT USED	NOT USED	NOT USED

NOTE: ABOVE ARE NOT THE ONLY METHODS, BUT THE MORE COMMONLY USED ONES.
* TRADE MARK OF THE INTERNATIONAL NICKEL CO.

chanical properties.

* * *

Corrosion problems can and do appear as a result of not removing some of the coatings from the wire prior to service. A good example would be seen in leaving lead on a stainless spring which is to be stress relieved at 750° F. and then placed into a service where an electrolyte is present. This electrolyte could be a weak acid, a salt water solution, or some other chemical. The result would be that cells or galvanic type corrosion would set up on the surface of the stainless wire from the lead sulfates or lead oxides which were created in the stress relieving process. Where lead itself is less noble than the stainless, the oxides of lead are more noble, which creates an undesirable condition resulting in pitting of the stainless. This same corrosion problem also applies to the molybdenum disulfides when not removed from the stainless wire. There apparently is little problem as far as corrosion is concerned with the other coatings mentioned, but it is always a good practice to remove all coatings prior to service.

* * *

WIRE ENGINEER
Methods and Process Knowledge of Wire Drawing, Stranding, Annealing and Plating: Salary Commensurate with Experience.
HUDSON WIRE COMPANY
62 Water Street
Ossining, New York

WANTED
working foreman for small stainless wire drawing and wire flattening operation. Experience necessary. Apply to:
ULBRICH STAINLESS STEELS, INC.
Old Colony Road
Wallingford Connecticut

For Sale
Wire Drawing Machines, Wilhelm Breitenbach, Unna, 1 single block, 1 double deck, Brand New, complete with 75 HP AC Motors, Controls, Tooling Dies, Pointer, 40 Spindles.
Reply to Box 1083
WIRE & WIRE PRODUCTS
453 Main St. Stamford, Conn.

MACHINERY WANTED
4" Copper Rolling Mill to flatten round copper to .0035. Call collect Ted Baum, WH 3-5793 (NYC)

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Alabama Wire Die Co., Fayette, Ala.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

ABRASIVES— Shot & Grit, For Cleaning
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ANNEALING MACHINES — Electric Resistance
Syncro Machine Co., Perth Amboy, N. J.
Walco Electric Co., Providence, R. I.

ANNEALING POTS AND BOXES—
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.

BAKERS—
(See OVENS—Rod Bakers)

BAR—Steel
Eaton Mfg. Co., Massillon, Ohio

BOBBINS—Braider & Wire Weaving
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Plastic Mold & Engineering Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

BORAX—Wire Drawing
U. S. Borax, New York, N. Y.

BRAZERS—Electric for Wire
Steele Company, M. G., Rome, N. Y.

CABLE ACCESSORIES
Southwire Co., Carrollton, Ga.

CABLE—Electric
Laribee Wire Inc., Camden, N. Y.
Southwire Co., Carrollton, Ga.

CABLE FILLERS—Paper
Ludlow Corporation, Needham Heights, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

CAPSTANS—for Wire (also Caterpiller Types)
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Div. of Franklin Research and Development Corp. Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Refractory
Amchem Products, Inc., Ambler, Pa.

CLEANERS—Metal
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Circle Chemical Co., Chicago, Ill.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Frankfort, Ill.

CLEANING & PICKLING EQUIP.—
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Morgan Construction Co., Worcester, Mass.
Wheelabrator Corporation, Mishawaka, Ind.
Wilson, Lee, Engr. Co., Cleveland, Ohio

CLOTH—Wire, All Metals—
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Chemical Products Corporation, E. Providence, R. I.
Magnuson Products Corp., Brooklyn, N. Y.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
U. S. Borax, New York, N. Y.

COLOR CONCENTRATES—For Wire Coatings
Blane Corporation, The, Canton, Mass.

COMPOUNDS—Brazing
Steele Company, M. G., Rome, N. Y.

COMPOUNDS—Coppering
Amchem Products, Inc., Ambler, Pa.
Circle Chemical Co., Chicago, Ill.
Miller, R. H. Co., Inc., Homer, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Alabama Wire Die Co., Fayette, Ala.
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

COMPOUNDS—Extrusion, for Wire
Amchem Products, Inc., Ambler, Pa.
Blane Corporation, The, Canton, Mass.
Circle Chemical Co., Chicago, Ill.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

COMPOUNDS—For Improving Drawing & Extrusion
Amchem Products, Inc., Ambler, Pa.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Metal Finishing
Amchem Products Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Chemical Products Corporation, E. Providence, R. I.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Phosphate Coating
Amchem Products Inc., Ambler, Pa.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Rust Preventing
Amchem Products, Inc., Ambler, Pa.
American Lanolin Corp., Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Chemical Products Corporation, E. Providence, R. I.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Rust Removing
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corp., Brooklyn, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS—Vinyl
Blane Corporation, The, Canton, Mass.
Chemical Products Corporation, E. Providence, R. I.
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Union Carbide Plastics Company, Div. of Union Carbide Corporation, New York, N. Y.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Climax Molybdenum Co., Div., American Metal Climax, Inc., New York, N. Y.
Magnuson Products Corp., Brooklyn, N. Y.
Miller, R. H. Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
Swift & Company, Chicago, Ill.
U. S. Borax, New York, N. Y.

CONDUCTORS—Flexible, Electrical
Laribee Wire Inc., Camden, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

CONTROL PANELS—
Walco Electric Co., Providence, R. I.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Morgan Construction Co., Worcester, Mass.

CUTTING TOOLS—Carbide
Eastern Carbide Corp., New Rochelle, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

CUTTING TOOLS—Wire
Manco Mfg. Co., Bradley, Ill.
Porter, H. K., Inc., Somerville, Mass.
Robinson, M. W. Co., Rockville, Conn.

DIAMONDS—Industrial
Alabama Wire Die Co., Fayette, Ala.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Indiana Wire Die Co., Ft. Wayne, Ind.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIAMOND POWDERS—
Danforth Company, C.W., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Fort Wayne Diamond Products, Inc., Fort Wayne, Indiana
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIAMOND POWDER RECLAIMING—
Alabama Wire Die Co., Fayette, Ala.
Danforth Company, C.W., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Fort Wayne Diamond Products, Inc., Fort Wayne, Indiana
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Wayne Wire Die Co., Linden, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

DIES—Diamond
Alabama Wire Die Co., Fayette, Ala.
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J. Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Ft. Wayne Wire Die Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES DIAMOND—Controlled Drawing Angle
Hoosier Wire Die, Inc., Fort Wayne, Ind.

DIES DIAMOND—Reversible
National Wire Die Co., Inc., New York, N. Y.

DIES—Extrusion
Alabama Wire Die Co., Fayette, Ala.
Central Tool and Machine Co., Bridgeport, Conn.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

Rusch Wire Die Corp., Croton-on-Hudson, N.Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Fenn Manufacturing Co., Newington, Conn.
Sjogren Tool & Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
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Kelly Wire Die Corp., New York, N. Y.
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New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Swaging
Fenn Manufacturing Co., Newington, Conn.
Sjogren Tool & Mach. Co., Inc., Auburn, Mass.

DIES—Tinning
Roux Wire Die Works, Inc., Oriskany, N. Y.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Variable Speed
Allis Co., Louis, Milwaukee, Wisc.
Walco Electric Co., Providence, R. I.

DRUMS—Wire Packaging
Hubbard Spool Company, Div., Van Norman Industries, Inc., Garrett, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Company, Div., Van Norman Industries, Inc., Garrett, Ind.
Republic Steel Corp., Berger Div., Canton, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio

DUST COLLECTORS—Wet or Dry
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

ENGINEERS—Consulting
Bawden, William D., Wilton, Conn.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Chemical Products Corporation, E. Providence, R. I.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Annealing, Vacuum
American Laubscher Corporation, New York, N. Y.

FURNACES—Galvanizing Equipment
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Carl Mayer Corp., The, Cleveland, Ohio
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)
Wilson Lee Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)

FURNACES—Strand Annealing
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GUIDES—For Wire
Alabama Wire Die Co., Fayette, Ala.
Heany Industrial Ceramic Corp., New Haven, Conn.
Indiana Wire Die Co., Fort Wayne, Ind.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool & Machine Co., Auburn, Mass.

HOISTS—Electric
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Walco Electric Co., Providence, R. I.

INHIBITORS—Pickling
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Chemical Products Corporation, E. Providence, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS—
Blane Corporation, The, Canton, Mass.
Dow Corning Corporation, Midland, Mich.
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

LACQUERNG SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Climax Molybdenum Co., Div., American Metal Climax, Inc., New York, N. Y.
Swift & Co., Chicago, Ill.

MACHINE CONTROLS—Electronic
Allis Co., Louis, Milwaukee, Wisc.

MACHINERY—Armoring (Cable, Wire, Hose)
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan

MACHINERY—Blast Cleaning
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

MACHINERY—Bobbin Winders
Hanson & Edwards, Ltd., Warrington, England

MACHINERY—Bolt, Rivet, Screw, etc.
Gavlick Machinery Corporation, Bridgeport, Conn.
National Machinery Co., Tiffin, Ohio
Prutton Corporation, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Braiding
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Fall, R. I.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Brazers for Wire
Steele Company, M. G., Rome, N. Y.

MACHINERY—Bunching
Cook Mfg. Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Niehaus K. A. Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Cable, Electric
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corp., New York, N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Chain Making
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Closing Cable
Miyazaki Iron Works, Ltd., Osaka, Japan
Niehaus, K. A. Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Coulter & MacKenzie Machine Co., Bridgeport, Conn.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Cold Forging
National Machinery Co., Tiffin, Ohio
Umtech Products, Inc., Hartford, Conn.

MACHINERY—Cold Heading
National Machinery Co., Tiffin, Ohio
REM Sales Incorporated, Subsidiary of The Robert E. Morris Co., West Hartford, Conn.
Straus-Artys Corp., Great Neck, N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
Cook Mfg. Co., The, Paterson, N. J.
Herborn Machinery Corporation, Hackensack, N. J.
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., New York, N.Y.
Morgardshammars Mek Verkstads A. B., Morgardshammar, Sweden
National Mach'y Exch., (Used), New York
Showa Machine Works, Ltd., Osaka, Japan
Straus-Artys Corp., Great Neck, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Whitacre Corporation, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Cutters, Hydraulic for Rod & Bar
Manco Mfg. Co., Bradley, Ill.
Porter, H. K., Inc., Somerville, Mass.

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Corporation, Alhambra, California
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Descaling Rod, Dry
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fisher Associates, New York, N. Y.
Herborn Machinery Corporation, Hackensack, N. J.
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Die Making
Alabama Wire Die Co., Fayette, Ala.
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Sjogren Tool & Machine Co., Auburn, Mass.
Wayne Wire Die Co., Linden, N. J.

MACHINERY—Draw Benches
American Laubscher Corp., New York, N. Y.

Gavlick Machinery Corporation, Bridgeport, Conn.
Loma Machine Manufacturing Co., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Edging (See MACHINERY—Tandem Rolling and Edging Mills)

MACHINERY—Enameling
Acrometal Products, Inc., Minneapolis, Minn.
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Cold Forging Machines, Inc., Elyria, Ohio

MACHINERY—Extruding
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England
Johnson Machinery Co., Elizabeth, N. J.
Royle, John, & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Flat Wire
Fenn Manufacturing Co., Newington, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Loma Machine Manufacturing Co., New York, N. Y.
Mettler Machine Tool, Inc., New Haven, Conn.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Forming Wire
Cold Forging Machines, Inc., Elyria, Ohio
Gavlick Machinery Corporation, Bridgeport, Conn.
National Mach'y Exch., (Used), New York, N. Y.
Straus-Artys Corp., Great Neck, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Galvanizing Wire
Miyazaki Iron Works, Ltd., Osaka, Japan
Ofenbau Fritz G.m.b.H. & Co., K. G., Hagen, (W.-Germany)
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.

MACHINERY—Insulating Wire
American Insulating Mach'y. Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Insulation Testing (See MACHINERY—Spark Testing)

MACHINERY—Lacquering Electric Wire
Cook Mfg. Co., The, Paterson, N. J.

MACHINERY—Lock Washer
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Looms, Wire Weaving
Cold Forging Machines, Inc., Elyria, Ohio
EVG., Machinen & Stahl, A. G., Zurich, Switzerland

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wisc.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

MACHINERY—Measuring and Control—Coating
Davis-Standard, Div. of Franklin Research and Development Corp., Mystic, Conn.

MACHINERY—Nail and Tack
Cold Forging Machines, Inc., Elyria, Ohio
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Co., Tiffin, Ohio
National Mach'y Exch. (Used), N.Y., N.Y.
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California

MACHINERY—Patenting Wire
Ofenbau Fritz G.m.b.H. & Co., K. G., Hagen, (W.-Germany)
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California

MACHINERY—Pin
REM Sales Incorporated, Subsidiary of The Robert E. Morris Company, West Hartford, Conn.

MACHINERY—Plating
Bartell Machine Tool Corp., Rome, N. Y.
Cold Forging Machines, Inc., Elyria, Ohio
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn Machinery Corporation, Hackensack, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch., (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Straus-Artys Corp., Great Neck, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Preheaters, Wire
Walco Electric Co., Providence, R. I.

MACHINERY—Printing on Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

MACHINERY—Re-Spooling
Acrometal Products, Inc., Minneapolis, Minn.
Bartell Machine Tool Corp., Rome, N. Y.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Miyazaki Iron Works, Ltd., Osaka, Japan
National Mach'y Exch. (Used), New York, N. Y.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc., (used), Pawtucket, R. I.

MACHINERY—Rod Mill
Herborn Machinery Corporation, Hackensack, N. J.
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Fenn Manufacturing Co., Newington, Conn.
Loma Machine Manufacturing Co., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Royle, John & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc., (used), Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Slitting Mills
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Special
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.

MACHINERY—Spring Making
Cold Forging Machines, Inc., Elyria, Ohio
Gavlick Machinery Corporation, Bridgeport, Conn.
National Mach'y Exch., (Used), New York, N. Y.
Wafios Machinery Corp., Hackensack, N. J.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Straightening & Cutting
American Laubscher Corp., New York, N. Y.
Cold Forging Machines, Inc., Elyria, Ohio
Gavlick Machinery Corporation, Bridgeport, Conn.
Johnson Machinery Co., Elizabeth, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Loma Machine Manufacturing Co., New York, N. Y.
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N.Y.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wafios Machinery Corp., Hackensack, N. J.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Bartell Machine Tool Corp., Rome, N. Y.
Cold Forging Machines, Inc., Elyria, Ohio
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Phila., Pa.
Johnson Machinery Co., Elizabeth, N. J.
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Fenn Manufacturing Co., Newington, Conn.
Gavlick Machinery Corporation, Bridgeport, Conn.

MACHINERY—Tandem Rolling & Edging Mills
Fenn Manufacturing Co., Newington, Conn.
Loma Machine Manufacturing Co., New York, N. Y.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.

MACHINERY—Take-Up and Pay-Out
Acrometal Products, Inc., Minneapolis, Minn.
American Insulating Mach'y Co., Phila., Pa.
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Fenn Manufacturing Co., Newington, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England
Johnson Machinery Co., Elizabeth, N. J.
Miyazaki Iron Works, Ltd., Osaka, Japan
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine) France
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Corporation, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine) France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Prutton Corporation, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Tinning Wire
American Insuating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.

Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)
Universal Industrial Equipment Co., Secaucus, N. J.
Whitacre Corporation, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, Ohio

MACHINERY—Tube Mill, Cold Drawing
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., New York, N. Y.
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N.J.
Edmunds Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
Gavlick Machinery Corporation, Bridgeport, Conn.
Johnson Machinery Co., Elizabeth, N. J.
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Variable Speed Drives
Allis Co., Louis, Milwaukee, Wisc.

MACHINERY—Welded Wire Mesh
EVG, Maschinen und Stahl, A.G., Zurich, Switzerland
Schlatter, Ltd., H.A., Zollikon, Zurich
Sommer Products Company, Peoria, Ill.

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Davis Electric Co., Wallingford, Conn.
Davis-Standard Div. of Franklin Research and Development Corp., Mystic, Conn.
Emory Company, Robert J., Newark, N. J.
Federal Manufacturing Company, Wallingford, Conn.
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York, N. Y.
Cook Manufacturing Co., The, Paterson, N.J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fenn Manufacturing Co., Newington, Conn.
Gavlick Machinery Corporation, Bridgeport, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., New York, N. Y.
Miyazaki Iron Works, Ltd., Osaka, Japan
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Showa Machine Works Ltd., Osaka, Japan
Societa Generale Delle Macchine Mill, Milan, Italy
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Straus-Artys Corp., Great Neck, N. Y.
Superior Tool & Machinery Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Wartenweiler, Emilio, Milano, Italy—SAMP
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Whitacre Corporation, Alhambra, California
Wire Machinery Inc., Chicago, Ill.

MACHINERY—Wire Rope
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
American Laubscher Corp. New York, N. Y.
Larmuth (1947) Ltd., Cheshire, England

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio

MOLYBDENUM-DISULFIDE—Lubricants
Climax Molybdenum Company, a division of American Metal Climax, Inc., New York, N. Y.

MOTORS—Electric
Allis Co., Louis, Milwaukee, Wisc.
Walco Electric Co., Providence, R. I.

NAIL TOOLING—Tungsten Carbide
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Central Tool and Mach. Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Co., Winsted, Conn.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAPER—Coil Wrapping
Ludlow Corporation, Needham Heights, Mass.

PAPER—Insulating
Ludlow Corporation, Needham Heights, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

PLASTICS—for Wire Insulation
Blane Corporation, The, Canton, Mass.
Chemical Products Corporation, E. Providence, R. I.
Dow Corning Corporation, Midland, Mich.
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Union Carbide Plastics Company, Div. of Union Carbide Corporation, New York, N. Y.

PREHEATERS—Wire
Walco Electric Co., Providence, R. I.

PRINTING WHEELS—for Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

PULLERS AND GRIPS—for Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool & Mach. Co., Auburn, Mass.

RACKS—Wire Storage
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Acrometal Products, Inc., Minneapolis, Minn.
Mettler Machine Tool, Inc., New Haven, Conn.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Berger Div., Canton, Ohio

REELS & SPOOLS—Custom Made
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.

REELS—Plywood
Antrim Reel, Inc., Haverhill, Mass.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Carlton Manufacturing Co., Pawtucket, R. I.
Clark Manufacturing Co., J. L., Rockford, Illinois
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Berger Div., Canton, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Nelson Co., The, Baltimore, Md.
Republic Steel Corp., Berger Div., Canton, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
Antrim Reel, Inc., Haverhill, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Nelson Co., The, Baltimore, Md.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Eaton Mfg. Co., Massillon, Ohio
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Northwestern Steel & Wire Co., Sterling, Illinois
Sumitomo Metal Industries, Ltd., Osaka, Japan
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Yawata Iron & Steel Co., Ltd., Tokyo, Japan

ROPE—Wire
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons, Div., Colorado Fuel & Iron Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Removing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SCRAP WIRE—Bare or Insulated, Bought
Electro Metals Separation Co. Div. of M. J. Stavola & Co., Inc., Danbury, Conn.

SILICONE RUBBER—For Wire Insulation
Dow Corning Corporation, Midland, Mich.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—For Retail Sale of Wire
Antrim Reel, Inc., Haverhill, Mass.
Carlton Manufacturing Co., Pawtucket, R. I.
Clark Manufacturing Co., J. L., Rockford, Illinois

SPOOLS—Paper
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.

SPOOLS—Plastic
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.
Plastic Mold & Eng. Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

STAMPINGS—Steel
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS—
Jarke Manufacturing Co., Chicago, Illinois

STRAND—Galvanized Steel
Southwire Co., Carrollton, Ga.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)

TENSION METERS—for Wire
Boulin Instrument Corp., Pelham, N. Y.
Tensitron, Inc., Harvard, Mass.

TESTERS—INSULATION
(See Testing Equipment—for Dielectric Faults)

TESTING EQUIPMENT—Dielectric Faults in Insulation
Davis Electric Co., Wallingford, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.

TESTING EQUIPMENT—Physical
Scott Testers, Inc., Providence, R. I.
Steele Company, M. G., Rome, N. Y.

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL-Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

TRANSMISSIONS—Variable Speed (See Adjustable Speed Drives)

TRAVERSE & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

VARNISHES & LACQUERS—for Electric Wire
Chemical Products Corporation, E. Providence, R. I.
General Electric Company, Insulating Materials Section, Schenectady, N. Y.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
EVG, Maschinen and Stahl, A.G., Zurich, Switzerland
Herborn Machinery Corporation, Hackensack, N. J.
Micro Products Co., Chicago, Ill.
Schlatter, Ltd., H.A., Zollikon, Zurich
Sommers Products Company, Peoria, Ill.

WHEELS—for Printing on Electric Wire
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

WIRE—ACSR
Southwire Co., Carrollton, Ga.

WIRE—Aluminum
Malin & Co., The, Cleveland, Ohio
Southwire Co., Carrollton, Ga.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Ball & Roller Bearing
Eaton Mfg. Co., Massillon, Ohio

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Malin & Co., The, Cleveland, Ohio

WIRE—Brush
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.

WIRE—Building, Electric
Southwire Co., Carrollton, Ga.

WIRE—Bunched and Stranded
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Pittsburgh Steel Co., Pittsburgh, Pa.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Copper
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.
Malin & Co., The, Cleveland, Ohio
Southwire Co., Carrollton, Ga.

WIRE—For Electrical Conductors
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.

WIRE—Flat
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Montgomery Co., The, Windsor Locks, Conn.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Northwestern Steel & Wire Co., Sterling, Illinois
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Detroit Steel Corporation, Detroit, Mich.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Insulated
Southwire Co., Carrollton, Ga.

WIRE—Manufacturers
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Northwestern Steel & Wire Co., Sterling, Illinois
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Berger Div., Canton, Ohio
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Rylands Brothers Limited, Warrington, England
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Metalizing
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Malin & Co., The, Cleveland, Ohio

WIRE—Needle
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio

WIRE—Oil Tempered
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Preheaters
Walco Electric Co., Providence, R. I.

WIRE—for Prestressed Concrete
Rylands Brothers, Limited, Warrington, England

WIRE—Pin
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.

WIRE—Special Shapes
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Eaton Mfg. Co., Massillon, Ohio
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Stainless Steel
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Malin & Co., The, Cleveland, Ohio
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Nippon Stainless Steel Wire Mfg. Co., Ltd., Osaka, Japan.
Pittsburgh Steel Co., Pittsburgh, Pa.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Steel—Also Coppered and Galvanized Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Malin & Co., The, Cleveland, Ohio
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Northwestern Steel & Wire Co., Sterling, Illinois
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Rylands Brothers, Limited, Warrington, England
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Stranded & Bunched
Laribee Wire, Inc., Camden, N. Y.

WIRE—Tinned
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WRAPPING PAPER—Creped
(See PAPER-Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

YARNS—Wire Insulating
Chadwick Yarn Company, Pawtucket, R. I.
Synthetic Thread Co., Bethlehem, Pa.

The WATSON MACHINE COMPANY
ESTABLISHED 1845
PATERSON 16, NEW JERSEY, U. S. A.

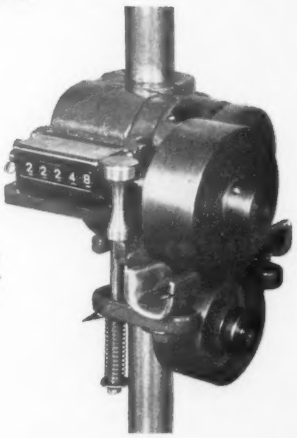
ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

WATSON

HEAVY DUTY MACHINES FOR LINEAR MEASUREMENT

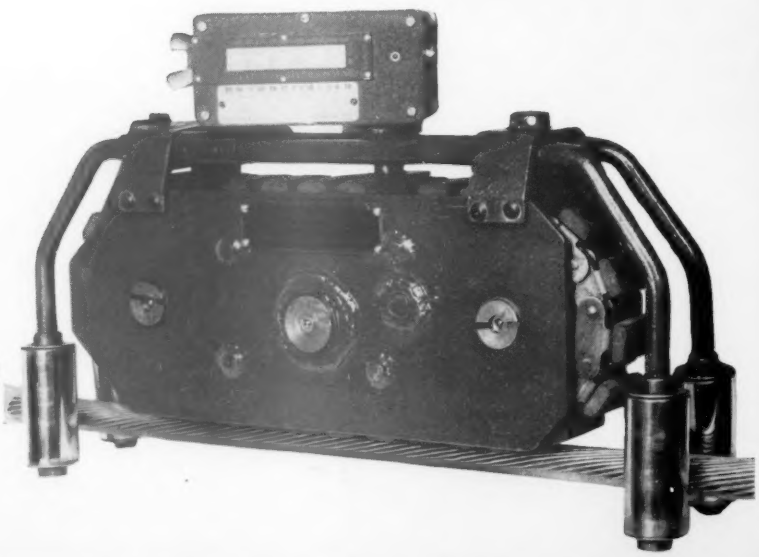
MANY SIZES AND MODELS AVAILABLE, OF WHICH THOSE SHOWN ARE EXAMPLES: LOW COST — 5 FIGURE RESET COUNTERS — HEAVY DUTY CONSTRUCTION — ALSO AVAILABLE ARE METRIC UNITS, PREDETERMINING COUNTERS WITH ELECTRICAL CONTACTS FOR SIGNAL OR INTERLOCKS WITH MOTOR STOP CIRCUITS — MEASURING CONTACT SURFACES TO MEET ANY REQUIREMENTS — HEAVY FLOOR STANDS — QUICK DELIVERIES — PARTS LIST AVAILABLE — REQUEST LITERATURE

WINDING, PAYOUT AND OTHER SHIPPING ROOM AND WAREHOUSE EQUIPMENT ALSO AVAILABLE



MODEL "FC" →

CATERPILLAR ARM TYPE ↓



↑ MODEL "DC3"

Our Design Aims: SAFETY — SIMPLICITY — PRODUCTIVITY

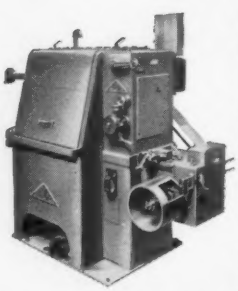
Here, There Can Be

no compromise with quality

Hurtling to the fringes of outer space at 4000 miles per hour, the pilot of the X-15 will be secure in the knowledge that the philosophy "no compromise with quality," was fundamental in her design and construction.

Vital to the success of the X-15's mission are the countless wire products concealed beneath her sleek exterior. Every day, manufacturers using machines bearing the name "SYNCRO," are producing such precision wire products.... For over 31 years our philosophy too, has been "NO COMPROMISE WITH QUALITY."

"Better Machinery for the Wire Industry"



Syncro Model A-16 Fine Wire Drawing Machine with spooler—Sizes ranging from #30 to #40 B&S Gauge (and smaller) can be finished at highest possible speeds. This is only one of the complete line of pace-setting Wire Drawing and Stranding Machines manufactured by Syncro Machine Company.

For further information write to: Syncro Machine Company, Perth Amboy, New Jersey

SYNCRO MACHINE COMPANY

affiliated company: Winget-Syncro Ltd., Rochester, Kent, England

Stranders • Continuous Electric Resistance Annealers • Payoffs • Take-Ups • Special Machinery